A FRAMEWORK FOR ASSESSING HEALTHCARE ENTERPRISE RESOURCE PLANNING POST-IMPLEMENTATION SUCCESS: A CASE OF CORDLIFE GROUP

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ABSTRACT

The role of Healthcare Enterprise Resource Planning (HERP) in the healthcare industry toward organisational business performance is imperative. Therefore, the organisations adopting HERP need to assess the success and impact of HERP post-implementation. Whilst, the Enterprise Resource Planning (ERP) have been largely researched, there is still a vacuum in researches in regards to HERP particularly in Malaysia. In this study, Information System Success Model (ISSM) was adopted from DeLone and McLean (D&M) to assess the HERP post-implementation success. Essentially, healthcare organizations can be benefitted from the success of implementing HERP with high staff operational work productivity and efficiency. This study focused on developing healthcare ISSM framework by analysing the relationships between the D&M ISSM success elements which are information quality, system quality, service quality, user satisfaction and individual benefits, in the case of CordLife Group. All constructs adopted the 5-point Likert scale measurement. The respondents were the HERP users from CordLife Group Limited-Singapore and StemLife Berhad-Malaysia with 184 and 180 respondents respectively with a response rate of 85%. The collected data was analysed using the SPSS and the SmartPLS software. This study found that all direct relationships amongst system quality, service quality, system quality, user satisfaction and individual benefits were significant. In addition, there were no differences between CordLife Group Limited-Singapore and StemLife Berhad-Malaysia on the determinants that affect CordLife Group's HERP post-implementation success. The study recommended incremental investments towards hardware and software upgrades, developing internal skilled expertise, persistent functional HERP training, boost user satisfaction and productivity by HERP adoption as necessary drivers towards achieving HERP post-implementation success.

Keywords: Information quality, system quality, service quality, user satisfaction and individual benefits.

ABSTRAK

Peranan *Healthcare Enterprise Resource Planning* (HERP) terhadap prestasi perniagaan organisasi penting dalam industri kesihatan. Oleh yang demikian, organisasi yang mengamalkan HERP perlu menilai kejayaan dan kesan pelaksanaannya. Walaupun terdapat banyak kajian mengenai Perancangan Sumber Perusahaan (ERP), masih terdapat ruang dalam kajian HERP terutamanya di Malaysia. *Information System Success Model* (ISSM) yang diadaptasi daripada DeLone dan McLean (D&M) digunakan untuk menguji kejayaan pelaksanaan HERP dalam kajian ini. Pada dasarnya, organisasi kesihatan dapat memanfaatkan kejayaan pelaksanaan HERP dengan produktiviti dan kecekapan kerja kakitangan yang tinggi. Kajian ini menumpukan kepada pembangunan kerangka kesihatan ISSM dengan menganalisis hubungan antara elemen kejayaan D&M ISSM yang terdiri daripada kualiti maklumat, kualiti sistem, kualiti perkhidmatan, kepuasan pengguna dan faedah individu, dalam kes CordLife Group. Kesemua konstruk menggunakan skala Likert 5-mata. Responden merupakan pengguna HERP daripada CordLife Group Limited-Singapore dan StemLife Berhad-Malaysia dengan jumlah responden sebanyak 184 dan 180 masing-masing mewakili kadar respon sebanyak 85%. Data yang dikumpul dianalisis menggunakan perisian SPSS dan SmartPLS. Kajian mendapati semua hubungan langsung antara kualiti sistem, kualiti perkhidmatan, kualiti sistem, kepuasan pengguna dan faedah individu adalah signifikan. Di samping itu, tiada perbezaan antara CordLife Group Limited-Singapura dan StemLife Berhad-Malaysia mengenai penentu yang mempengaruhi kejayaan pelaksanaan HERP CordLife Group. Kajian ini mencadangkan pelaburan tambahan ke arah peningkatan perkakasan dan perisian, membangunkan kepakaran mahir dalaman, latihan HERP berfungsi berterusan, meningkatkan kepuasan pengguna dan produktiviti oleh penggunaan HERP sebagai pemandu yang diperlukan ke arah mencapai kejayaan selepas pelaksanaan HERP.

Kata kunci: Kualiti maklumat, kualiti sistem, kualiti perkhidmatan, kepuasan pengguna dan faedah individu.

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LIST OF ABBREVIATIONS

AVE	Average Variance Extracted
CEO	Chief Operating Officer
CGL	CordLife Group Limited
COO	Chief Operating Officer
CR	Composite Reliability
CSF	Critical Success Factor
df	Degree of Freedom
D&M	DeLone and McLean
ERP	Enterprise Resource System
HERP	Healthcare Enterprise Resource System
IBS	Individual Benefits
IS	Information System
ISSM	Information System Success Model
IT	Information Technology
IQ	Information Quality
MYX	Malaysia Stock Exchange (Bursa Malaysia)
PEU	Perceived Ease of Use
PLS-SEM	Partial Least Squares-Structural Equation Modelling
PU	Perceived Usefulness
S.E.	Standard Error
Sig.	Significant
SLB	StemLife Berhad
SGX	Singapore Stock Exchange
SPSS	Statistical Package for Social Sciences
SQ	System Quality
SVQ	Service Quality
TAM	Technology Acceptance Model
TTF	Task Technology Fit
TRA	Theory of Reasoned Action
SAT	User Satisfaction
UTAUT	Unified Theory of Acceptance and Use of Technology
VIF	Variance Inflation Factor

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter presents the introduction of the research in eight separate sections. The first section begins with a background of the study followed by the problem statement in the second section. The third and fourth section discusses the research questions and the research objectives respectively. The fifth and sixth section deliberates the significance of the study subsequently the scope and limitation of this study. The seventh section highlights the definition of key terms. Last but not least, the eighth section relates to the organisation of the dissertation.

1.2 Background of the study

In Malaysia, the healthcare industry is classified into three categories, namely public healthcare, Non-Governmental Organisation (NGO) healthcare and private healthcare (Ministry of Health, 2015). Whereas, public hospitals and clinics are managed by Malaysian Ministry of Health (MOH) to deliver healthcare service to the public. However, the NGO hospitals, for example Hospital Universiti Malaya and Hospital Universiti Kebangsaan Malaysia, both are managed by universities to help the campus students and staff. Lastly, the private hospitals, clinics and healthcare organisations are managed by private organisations, for example KPJ Healthcare Berhad and IHH Healthcare Berhad. The present study uses CordLife Group as a case example of Healthcare Enterprise Resource Planning (HERP) post-implementation success

assessment. CordLife Group is a private healthcare organisation that handles cord blood banking services similar to the Malaysian National Blood Bank in MOH.

In the healthcare industry, unlike other business as wherein the lost could be deliberated only in financial terms (Ismail, Abdullah & Shamsuddin, 2015), the lost in this industry or sector is also in terms of human lives (Sulaiman & Wickramasinghe, 2014). In addition, clinicians, physicians, nurses and managers require quality instruments in order to improve and handle with evolving medical technologies and approaches to upholding excellent healthcare services (Hsiao & Chen, 2016; Poonam & Divya, 2014). For instance, a hospital operates data from many varying departments, some of which should be shared in order to deliver healthcare services (Sherer, Meyerhoefer & Peng, 2016; Yusof, 2015). Therefore, Handayani, Hidayanto and Budi (2017) highlighted that healthcare organisations ought to have computerised information systems, such as HERP in order to fulfil the demands of the excellence of healthcare services. Essentially, HERP is a computer system intended to accomplish all the facets of a hospital's operational work, such as clinical, administrative and financial activities (Ahmadi, Nilashi, Shahmoradi & Ibrahim, 2017). Being capable to retrieve medical information is important to the health fraternity since it supports them to be efficient and effective (Sherer, Meyerhoefer & Peng, 2016; Yusof, 2015).

For Singapore and Malaysia, HERP has a significant capacity to build up the patient service, healthcare competency, patient fulfilment and healthcare processes, for example, HERP can mitigate the dangerous medication error (Andargoli, Scheepers, Rajendran & Sohal, 2017). More importantly, HERP in healthcare domain is

anticipated to facilitate continuous quality of healthcare in aging societies (Handayani, Hidayanto, Sandhyaduhita & Kasiyah, 2015). On the other hand, Information System (IS) departments were considered only a minor in-house IS support service for other departments, such as customer management, finance and sales department (Andargoli, Scheepers, Rajendran & Sohal, 2017). However, with the greater incorporation of HERP in the functioning of organisations, the value of the IS support services provided by this department have grown exponentially (Sulaiman & Wickramasinghe, 2014; Yusof, 2015). Therefore, the need to rationalise the expenditure on HERP-based services and the importance of the services provided by IS departments have been widely recognised (Sherer, Meyerhoefer & Peng, 2016; Yusof, 2015).

HERP implementation is changing from legacy system into HERP as it is more on process change instead of technology change itself (Ahmadi, Nilashi, Shahmoradi & Ibrahim, 2017). In general, the phases on HERP implementation process has three main phases: pre-implementation, implementation and post-implementation (Ismail, Abdullah & Shamsuddin, 2015). In addition, HERP implementation life cycle is divided into 5 phases namely, project preparation, technology selection, project formulation, implementation/development and deployment (Sherer, Meyerhoefer & Peng, 2016; Yusof, 2015). The present study focused on post-implementation phase due to post-implementation phase have received relatively less attention in IS research.

Successful HERP is different from the successful HERP implementation which is often assessed by project management metrics like cost overruns and time estimation (Sulaiman & Wickramasinghe, 2014). Despite of the many benefits that HERP bring to

organisations, several studies have found that HERP project failures are very common (Sepucha, Simmons, Barry, Edgman-Levitan, Licurse & Chaguturu, 2016). Success could be observed as a realisation of a purpose, business reputation or achievement (Snead, Magal, Christensen & Amadi, 2015). Nonetheless, in HERP, success is the practicality of the information system for healthcare users and managers (Safdari, Ghazisaeidi & Jebraeily, 2015). The concept of HERP success used in this study is the successful use of HERP for the organisational effectiveness at post-implementation phase (Hsiao & Chen, 2016; Poonam & Divya, 2014). With the escalating implementation of information system within the organisation and their expenditures, it is important to evaluate the value of the services delivered by HERP, particularly in a thorough assessment method (Villalba-Mora, Casas, Lupiañez-Villanueva & Maghiros, 2015) and ensuring their successful HERP post-implementation phase positive effects on healthcare service (Safdari *et al.,* 2015). Therefore, many studies support the importance of Information System Success Model (ISSM) for HERP success assessment and improvement (Ram, Corkindale & Wu, 2013). Due to the massive investments on the enhancement and deployment of HERP, the assessment of the success or failure of these systems is definitely needed to realise their actual benefit and proficiency (Safdari *et al.,* 2015; Zakaria & Yusof, 2016).

In fact, the post-implementation success of the HERP is very difficult to be maintained due to the complexity of the HERP (Sulaiman & Wickramasinghe, 2014). Hence, numerous elements of success, such as human factors and technological factors should be considered (Ismail, Abdullah & Shamsuddin, 2015). Besides, insufficient training and resistance of HERP users could be the key reasons for HERP failure (Ahmadi *et al,*

2017). The assessment of the users' perception of the HERP and quantifying their satisfaction instead of reflecting technical facets of these systems is extremely critical because HERP is deemed ineffective if its users realise it as a poor system (Ahmadi, Ibrahim, Thrusamy, Mun, Mojtaba, Jafakarimi & Almaee, 2015). Thus, SERVQUAL instrument has been a frequently used tool to conduct surveys on satisfaction related to human-oriented service quality (Villalba-Mora *et al.*, 2015). Another essential point, some of the related literature disputed that human factor in term of satisfaction, especially physicians and nurses is critical for HERP success (Handayani *et al.*, 2017; Villalba-Mora *et al.*, 2015; Zakaria & Yusof, 2016).

HERP assessment is useful for policy decision making and budget provision to foster the HERP (Andargoli *et al.*, 2017). From the practical perspective, this also makes it appealing to assess the definite benefits of the HERP and their role in healthcare organisations (Villalba-Mora *et al.*, 2015). Fortunately, there has been a huge number of ISSM available for researchers in this endeavour (Andargoli *et al.*, 2017). However, in the healthcare industry, there is a lack of studies in-depth understanding the HERP post-implementation success assessment (Ismail *et al.*, 2015). Despite the HERP has been utilised in business for beyond three decades, absolutely successful cases of these systems are not generally highlighted (Handayani *et al.*, 2017). Hence, there is a need for better understanding of HERP post-implementation success assessment by specialising in a case example of CordLife Group.

1.3 Problem statement

Malaysian healthcare faced several issues, particularly dissatisfaction arises among the Malaysian public on healthcare services rendered by Malaysian healthcare (Ahmadi, Nilashi, Shahmoradi & Ibrahim, 2017). For example, the news titled "Patients foregoing treatment due to long waiting time in Malaysian hospital service" had appeared in the Monthly Index of Medical Specialities (MIMS) Today online on 15th August 2017 (Reshmin, 2017). The news elaborates frustration among the Malaysian public on the long waiting time, patient congestion, increase healthcare cost and slow healthcare services provided in Malaysian healthcare. Furthermore, these issues acknowledged by Malaysian Director General of Health Malaysia namely Datuk Dr. Noor Hisham Abdullah in reporting the update on Malaysian public healthcare issues and challenges 2015 (see Figure 1.1).

Therefore, the present study is reasonable to be conducted as an appropriate contribution to tackle the aforementioned discussed healthcare issues by stimulating the success case of HERP post-implementation in Malaysian healthcare. Accordingly, the above discussion had extensively outlined the importance of HERP, in contributing to the quality healthcare service by clinicians, physicians and nurses to patients in the healthcare industry. Nevertheless, Table 1.1 shows several of the latest Malaysian and Singaporean healthcare industry issues that were reported in online media. In addition, Figure 1.1 depicts issues and challenges faced by Malaysian public healthcare that reported by Datuk Dr. Noor Hisham Abdullah throughout official website from the Desk of the Director-General of Health Malaysia.

Table 1.1

The summary of healthcare industry issues in Malaysia and Singapore

No.	Healthcare Industry Issues	Writer	Publication	Date
1	Talents Needed To Sort Out Issues In Healthcare	Dr. Johari Bux	The Star Online	08/06/2018
2	KPJ Gears Up For Industry 4.0	Toh Kar Inn	The Star Online	20/04/2018
3	What Malaysians Say About Going To Government Hospital For Treatment	Haziq Alfian	Malaysia Digest online	08/03/2018
4	Aiding Healthcare Through Data Analytics.	Kamal Brar	The Star Online	31/01/2018
5	What Drives Malaysians To Slag Off Our Own Healthcare?	Zurairi AR	Malaymail online	10/09/2017
6	Hours-Long Hospital Waits Driving Some To Abandon Treatment.	Boo Su-Lyn	Malaymail online	22/08/2017
7	Patients Foregoing Treatment Due To Long Waiting Time In Malaysian Hospital Service.	Reshmin Kaur Cheema	MIMS Today	15/08/2017
8	Big Data In Healthcare: What We Need To Know.	Shazwan Mustafa Kamal	Malaymail online	21/04/2017
9	Health Ministry Launches Malaysian Health Data Warehouse.	Joseph Kaos Jr	The Star Online	18/04/2017
10	The Big Healthcare Issues That Malaysia And Singapore Need To Address.	NA	Asean Today online	11/01/2017

Source: Online media (2017 & 2018)

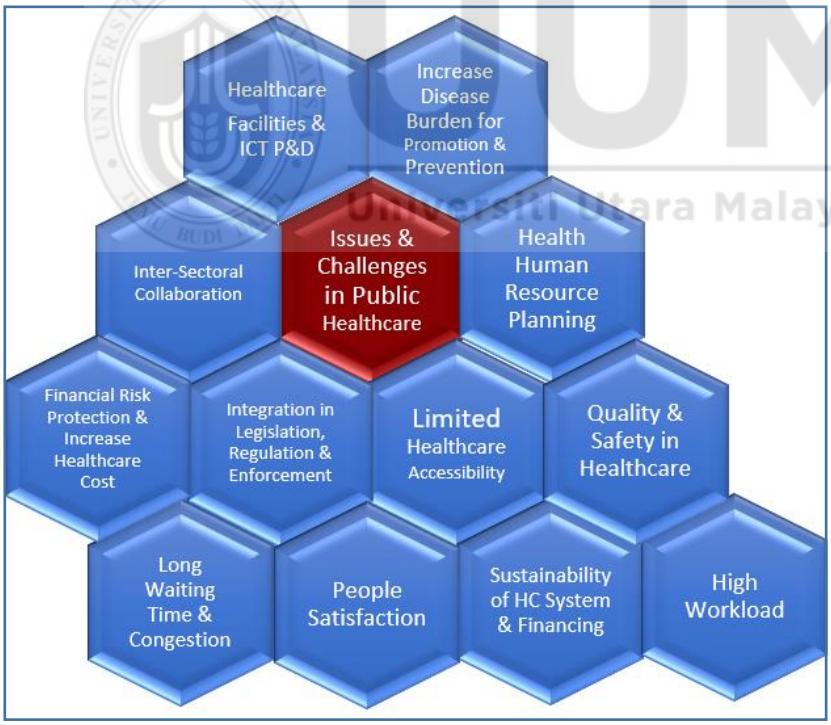

Figure 1.1

The summary of public healthcare issues and challenges in Malaysia

Source: From the Desk of the Director-General of Health Malaysia Datuk Dr. Noor Hisham Abdullah (2015)

The proportion of the Singapore population aged 65 years and above will increase from 8.4% in 2005 to 18.7% in 2030 (Department of Statistics Singapore, 2016). Singapore healthcare sector faced the growing costs, increase of chronic diseases, spread of epidemics and the shortage of qualified medical practitioners (State of Health, 2015). For Singapore, the integration of HERP to achieve seamless flow of information across different healthcare establishments is a crucial challenge (Lim, 2015). Furthermore, patient safety and quality of care are still a remaining challenge to overcome, therefore, to improve healthcare quality for all residents, increase patient safety, lower healthcare costs and develop more effective health policies, the adoption of successful HERP is imperative (Accenture, 2016). In this era of increasing healthcare system burden, the adoption of HERP holds significant potential for facilitating cost-effective, value-based and patient-centred care (Accenture, 2016).

Essentially, Singapore also faced the similar reported Malaysian healthcare issues and challenges as narrated in the news titled "The big healthcare issues that Malaysia and Singapore need to address" as appeared at Asean Today online dated 11th January 2017 (Asean Today Online, 2017). The main similarities between the healthcare systems in Malaysia and Singapore, both of them are facing the burning issues in long waiting time, congestion and high workload. Therefore, both might be recommended to execute a comparable technique to the highlighted challenges as they struggle to fulfil the healthcare needs today and also deliver excellent service for future care.

In general, a successful HERP implementation project might not certainly ensure success in the post-implementation phase (Ha & Ahn, 2014). However, the available IS

literature for the in-depth understanding the ERP post-implementation success assessment is mostly generic in nature and can be applied in a variety of business sectors or industries (Ha & Ahn, 2014; Hsiao & Chen, 2016; Ram, Corkindale & Wu, 2013). Besides, there are limited studies, particularly the empirical or practical studies related to HERP in Malaysia setting (Ahmadi, Nilashi, Shahmoradi & Ibrahim, 2017). In addition, the practical studies mainly dedicated on CSF for ERP implementation phase in organisation level (Ahmadi *et al.,* 2017; Ismail *et al.,* 2015; Yusof, 2015). Obviously, with the limitation of such studies would restrain our interpretation of how to materialise HERP post-implementation success in the Malaysian healthcare industry (Ahmadi *et al.,* 2017). Consequently, it was argued that there is a need for research in better understanding the determinants to assess HERP post-implementation success in the healthcare industry (Ahmadi *et al.,* 2015; Sepucha *et al.*, 2016). This instigates a need for research to examine the success elements of HERP post-implementation in the healthcare industry (Ismail, Abdullah & Shamsuddin, 2015).

Over the years, HERP has been presented into healthcare industries with the missions to integrate the quality consumption of information systems to mitigate medical error, control costs, facilitates efficient decision making and support the new discoveries for medical solutions (Ahmadi *et al.,* 2017; Sepucha *et al.,* 2016). However, several issues and challenges occur due to internal and external aspects of HERP post-implementation success (Ahmadi *et al.*, 2017; Masrom & Rahimly, 2015; Sherer, Meyerhoefer & Peng, 2016). For example, Malaysian public healthcare faced with the escalating cost of healthcare expenditure due to a sizable of patients' needs to be served at the same time and physicians and nurses are highly loaded with healthcare

managerial and administrative duties, respectively (Ahmadi *et al.*, 2017). In addition, the information quality and system quality aspect of the HERP adopted also highly criticized as the causes of poor HERP service delivered (Ismail, Abdullah & Shamsuddin, 2015).

In Malaysia, there are 141 public healthcare infrastructures encompassing 137 hospitals and 4 exclusive medical institutions acquiring greater than 39,000 beds (Ministry of Health, 2015). In addition, it was reported that 8.39% of the overall Ministry of Health (MOH) is distributed from the national budget (Ministry of Health, 2015). Shockingly, only 22 out of 137 public hospitals are completely incorporated or partly incorporated with HERP (Masrom & Rahimly, 2015). This confirms the slow growth rate of HERP implementation and the relatively low success case of HERP post-implementation in Malaysian healthcare industry (Ahmadi *et al.,* 2017; Ismail *et al.,* 2015; Masrom & Rahimly, 2015). Furthermore, the fact was supported by merely 15.2% of Malaysian public hospitals adopted HERP (Ismail *et al.,* 2015). In addition, few hospitals adopted various types of HERP, such as Patient Management System, Pharmacy Information System (PIS), Radiology Information System (RIS), Picture Archiving and Communication System (PACS) and Clinical Access Information System (Ahmadi *et al.,* 2015). Besides, the trend of ERP project for the last five years shows almost the same pattern that is between 27% to 31% successful, 49% to 56% challenged and 17% to 22% failed (Standish, 2015). Therefore, the present study tends to satisfy a gap within the latest IS literature throughout the development of a proper framework in governing HERP post-implementation success assessment.

On the other hand, for the theoretical gaps: Firstly, the DeLone and McLean (D&M) ISSM is widely used, but seldom applied in HERP post-implementation success assessment (Ahmadi, Nilashi, Shahmoradi & Ibrahim, 2017). Therefore, D&M ISSM can be a practical lens to explore the potential success elements which shape the HERP post-implementation success of healthcare organisations (Andargoli, Scheepers, Rajendran & Sohal, 2017). Secondly, the SERVQUAL instruments have extensively been studied in the marketing field, but rarely adopted for assessing HERP post-implementation success (Ismail, Abdullah & Shamsuddin, 2015). Eventually, the researcher attempts to interpret the empirical findings on the relationships among success elements from the D&M ISSM and the adopted SERVQUAL in the context of HERP. In addition, there is a lack of studies to explore the interrelationship between Service Quality (SVQ) and other success elements as part of the theoretical contribution (Izogo & Ogba, 2015; Rajaratnam *et al*., 2014). Essentially, based on the explained arguments are justified for the present study in developing a framework based on the aforementioned theories and instruments.

1.4 Research questions

In line with the study background and the problem statement discussed in the preceding subheadings, the broad research question to which this study attempts to provide is: How can HERP post-implementation success in CordLife Group be assessed? Based on the broad research question, the present study is guided by the following specific questions:

1. What are the determinants that affect CordLife Group's HERP post-implementation success?

2. Can the success elements of the D&M ISSM be used as determinants that affect CordLife Group's HERP post-implementation success?
3. What are the differences between CordLife Group Limited-Singapore and StemLife Berhad-Malaysia on the determinants that affect CordLife Group's HERP post-implementation success?

1.5 Research objectives

Subsequent to the aforementioned research questions, the main objective of this study is to propose a framework for assessing HERP post-implementation success by using a case example of CordLife Group. Essentially, this study is guided by the following specific objectives:

1. To identify the determinants that affect CordLife Group's HERP post-implementation success.
2. To integrate the D&M ISSM success elements as determinants for assessing CordLife Group's HERP post-implementation success.
3. To identify the differences between CordLife Group Limited-Singapore and StemLife Berhad-Malaysia on the determinants that affect CordLife Group's HERP post-implementation success.

1.6 Significance of the study

In order for healthcare organisations to stay competitive, there is a need of continual efforts to instigate new methods of creating business opportunities and acquire competencies to serve their valued customers (Ismail, 2015). In addition, numerous healthcare organisations are in the midst of employing HERP, whereas more

organisations sustained many years of practice in upholding their HERP (Sulaiman & Wickramasinghe, 2014). Whereas, it was reported that several healthcare organisations been incapable to successfully expand their HERP to accomplish business revenue success (Ahmadi *et al.*, 2017). Subsequently, the results from the present study definitely can be utilised to benefit organisations in comprehending the success elements that motivate users in the HERP context. In such situation, the significant contributions of this study comprise of practical and theoretical aspects.

1.6.1 Significance of the study to practitioners

On the significance of the present study to the healthcare practitioners and healthcare industry, such as MOH, healthcare NGO and private healthcare organisations, the proper framework of HERP post-implementation success assessment is foreseeable to stimulate the growth of successful HERP cases of realisation and utilisation of HERP benefits. This study provides comprehensive empirical evidence of the success elements of technological factors: HERP qualities like SQ and IQ and also human factors: SVQ from in-house IS staff together with SAT and IBS in CordLife Group. It is anticipated that the outcomes of this study are capable to assist healthcare IS managers or professionals to justify further investment and efforts in improving the implemented HERP in their healthcare organisations.

As Malaysia is focused on building an edge-based economy and becoming highly dependent on Information Technology to spearhead its drive to be in the information age, the demand to ensure successful implemented HERP to boost up healthcare business performance becomes more critical than ever. Every healthcare organisation

needs to be more equipped with practical knowledge on how to manage company HERP. This is also in line with the initiative for increasing HERP post-implementation success rate with the favour participation and adoption of users within the organisation. Therefore, healthcare IS managers or professionals must ensure the HERP is reliable and consistently serve the user's expectation with a high satisfaction. Last but not least, this study provides a better understanding of the healthcare IS decision makers on the significant role of in-house IS staff in relation to organisational performance and encourages their participation at the strategic level.

1.6.2 Significance of the study to academics

The present study aims to make the contribution to the existing IS theories and knowledge repositories for future references. Firstly, the D&M ISSM rarely applied in HERP post-implementation success assessment. Secondly, the SERVQUAL seldom to be adopted for assessing HERP post-implementation success. Therefore, the researcher steals the limelight in the present study by interpreting the empirical findings on the relationships among success elements from the D&M ISSM and the adopted SERVQUAL in the context of HERP. In addition, the previous studies, Gable *et al*. (2008) and Sedera *et al*. (2004) argued the need to re-conceptualise the ISSM as the gap in the IS literature lies in the insufficient studies on the interrelationships among success elements: SQ, SVQ, IQ, SAT and IBS. Eventually, this study enhances the current knowledge of the HERP impact on individual user level performance in the Malaysian healthcare industry.

1.7 Scope of the study

The present study emphasises on the individual user level where the target respondents were the HERP users in the setting of the healthcare industry with a case example of CordLife Group. Nonetheless, this research setting is limited for two neighbouring countries, namely CordLife Group Limited (CGL) Singapore and StemLife Berhad (SLB) Malaysia. Subsequently, this study applied a quantitative method, in which questionnaires were employed for the purpose of collecting data from the identified samples. The D&M ISSM (2003) together with the SERVQUAL from marketing field is adopted for the present study, despite many IS theories available. Therefore, the scope of this study is limited to five constructs: SQ, SVQ, IQ, SAT and IBS. In regard to IQ, two measurement components are Context (ICT) and Representation (IRP) items. Whereas, SQ also consists of two components of System-related (SSR) and Task-related (STR) items. However, SVQ is formed throughout the five dimensions, namely Tangibility (TAN), Reliability (REL), Responsiveness (RES), Assurance (ASS) and Empathy (EMP). SAT consists of four items to measure satisfaction on the HERP's IQ, SVQ, SQ and overall of the HERP general satisfaction. Last but not least, the dependent variable of this study is IBS that represented by four items that measure productivity, effectiveness, awareness and accessibility of job-related information and learning.

1.8 Definition of key terms

Sekaran (2003) believes that the operational definition is significant in defining a concept to render that it is quantifiable and is done by observing the facets, characteristically dimensions that represented by the concept.

In accordance, this study operates several key terms that are necessary to be understood clearly. The definitions of key terms used in this study are described in Table 1.2. Additionally, they are further elaborated in detail in the operationalisation of the variables section in Chapter Four.

Table 1.2
Definition of Key Terms

No.	Key Term	Operational Definition
1	HERP	Healthcare Enterprise Resource Planning (HERP) system, is an enterprise information system designed to integrate and optimise the business processes and transactions in a corporation.
2	Individual Benefits (IBS)	Individual benefits refer to the effect of information on the behaviour of the recipient or the extent to which the HERP has influenced users' capabilities and effectiveness.
3	User Satisfaction (SAT)	User satisfaction as the degree to which HERP users are satisfied with the decision to use a system and whether it met their expectations.
4	System Quality (SQ)	System quality represents the quality of the HERP itself, which includes software and data components and it is a measure of the extent to which the system is technically sound.
5	Information Quality (IQ)	Information quality refers to the quality of outputs the HERP produces, which can be in the form of reports or online screens.
6	Service Quality (SVQ)	Service quality is defined as the degree to which HERP users are convinced that the necessary resources and technical assistance that delivered by the IS department in the organisation.

1.9 Organisation of the dissertation

This dissertation is presented in six chapters. Firstly, the Chapter One generally provides an overview of the present study by drawing an extensive outline, therefore it sets the foundation for the following chapters. This chapter is made up on the background of the study, problem statement, research questions, research objectives, the significance of the study to practitioners and academics, scope of the study, the definition of key terms and lastly the organisation of the dissertation.

Subsequently, Chapter Two provides an overview of the HERP post-implementation phase in the Malaysian healthcare industry with a case example of CordLife Group. The chapter discusses the corporate profile of CGL-Singapore, SLB-Malaysia and subsidiaries then CGL-Singapore's accreditations earned in 2010-2016. This chapter explores in-depth about the HERP in Malaysian healthcare industry and CordLife Group exclusively.

Next, Chapter Three reviews previous studies relating to the five main constructs of this study: SQ, SVQ, IQ, SAT and IBS. The review of IS literature establishes the in-depth understanding of the IS field. It covers the origination of HERP quality components, SAT and IBS. The chapter also explains the underpinning theory and previous empirical evidence that is linked to the scope of the present study.

Chapter Four outlines the theoretical platform for this study, which focus on the present study's research framework, the overall relationship between the variables, the derivation of the hypotheses in this study. Furthermore, explores the methodological choices, which includes the selection of research design and methods of data analysis applied in achieving the research objectives. It also covers the research population and sampling, data collection methods, development of the survey instrument and identification of the measurement items.

Chapter Five provides an overview of the study's analysis and findings. It has presented findings on the response rate, profile of respondents and the statistical

results. The statistical analysis and findings that referred to the results of the tested hypotheses and the research objectives.

Finally, Chapter Six the last chapter had discussed the implication of managerial and theoretical perspectives for the present study. The research objectives and its findings were discussed in the same chapter, including results comparison to prior studies. The chapter had concluded the limitations and recommendations that discussed thoroughly for the future research.

CHAPTER TWO

CORDLIFE GROUP AND THE IMPLEMENTATION OF HERP

2.1 Introduction

This chapter presents an overview of HERP post-implementation phase in the Malaysian healthcare industry with a case example of CordLife Group. The chapter is classified into three sections. The first section begins with the corporate profile of CordLife Group Limited (CGL) Singapore, StemLife Berhad (SLB) Malaysia and subsidiaries. The second section elaborates the CGL-Singapore's accreditations earned in 2010-2016. Last but not least, the third section discusses the HERP in Malaysian healthcare industry and CordLife Group exclusively.

2.2 CordLife Group Limited and subsidiaries

CordLife Group Limited (CGL) Singapore and collectively with its subsidiaries, CordLife Group are shown in Figure 2.1. Whereas, CGL-Singapore increased its interest in StemLife Berhad (SLB) Malaysia, from an initial 31.81% to 89.88% and consolidated SLB-Malaysia as a subsidiary since 2014. Subsequently, SLB-Malaysia has implemented several initiatives to reap greater cost efficiencies through economies of scale approach by aligning with CordLife Group's practices, particularly the HERP adoption. Essentially, CordLife Group headquarter, CGL-Singapore has launched an integrated brand campaign to engage prospective clients through HERP digital platforms like Microsoft® Dynamics Navision and CRM since 2015. Furthermore, the HERP links all the customer's data from the upstream processes, for example, medical laboratory to the downstream processes like customer management and marketing

campaign to boost the business efficiency. For example, enhancement in HERP financial reports quality to comply with the standard requirements of Singapore Stock Exchange (SGX).

Figure 2.1
CordLife Group Limited and subsidiary countries
Source: CordLife Group Limited Annual Report (2016)

Table 2.1
CordLife Group Limited financial highlights (2014, 2015 & 2016)

	2014	2015	2016
Revenue (S$'000)	49.1	57.6	59.6
Gross profit (S$'000)	34.9	40.0	39.5
Profit before income tax from operations (S$'000)	9.1	6.1	2.9
Net Profit (S$'000)	30.4	32.1	12.6
Net asset value per share (cents)	53.5	62.5	51.2
Cash and cash equivalents, short term investments and fixed deposits (S$'000)	45.4	29.2	138.1

Source: CordLife Group Limited Annual Report (2016)

For the past three years, CordLife Group total revenue hovered around S$49.1-S$59.6 million dollars, however net profit had decreased by S$30.4-S$12.6 million dollars. Therefore, CGL-Singapore's Chief Executive Officer (CEO), Dr. Wong Chiang Yin seeks IS department on HERP contributions as part of CordLife Group's business

operations overhaul plan to boost up employees' work productivity while to stay at minimal cost expenditures. CGL-Singapore's financial highlights (2014, 2015 & 2016) is shown in Table 2.1.

2.3 CordLife Group Limited's accreditations (2010–2016)

Generally, the processing and storing infrastructures in Hong Kong, India, the Philippines and Singapore are qualified by AABB accreditation, the organisation behind the world's premium criterion for cord blood investment. Furthermore, their infrastructures in Indonesia and Malaysia are ISO-specialised. Subsequently, in 2015, CGL-Singapore received accreditation from FACT-Netcord, the same outstanding international endorsement organisation for cord blood banks. Eventually, this builds CGL-Singapore as one of top six cord blood banks within the world to be qualified AABB and FACT-Netcord.

2.4 HERP in Malaysian healthcare industry

HERP in Malaysian healthcare began actively since the era of MSC. Malaysia had an era of an integrated HERP, conversely, today is being hampered by budget constraints. Healthcare facilities, particularly HERP, the numbers continue to grow due to functional needs, but faced a large of challenges in post-implementation phase despite its obvious benefits. As the Figure 2.2 shown below, healthcare is one of the top Malaysia industries with a high historical growth rate and output multipliers. Next, HERP plays an important role to assure Malaysia MOH service are delivered at optimum level with a high satisfaction from HERP users and positively impact the

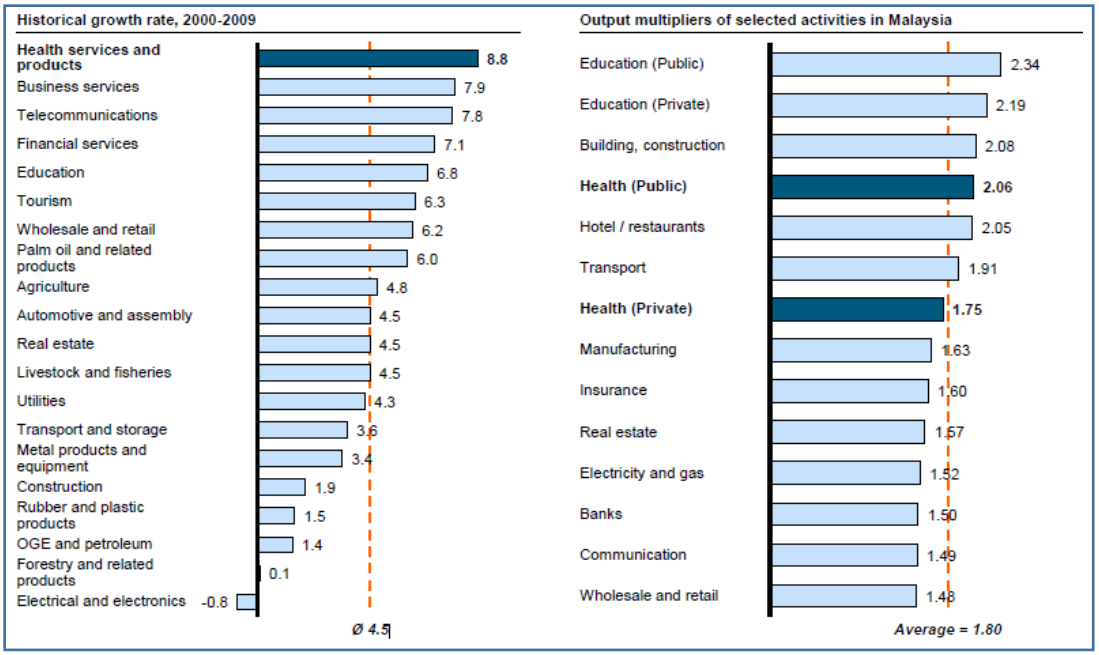

Figure 2.2
Malaysia industries historical growth rate and output multipliers
Source: Department of Statistics, Malaysia (2017)

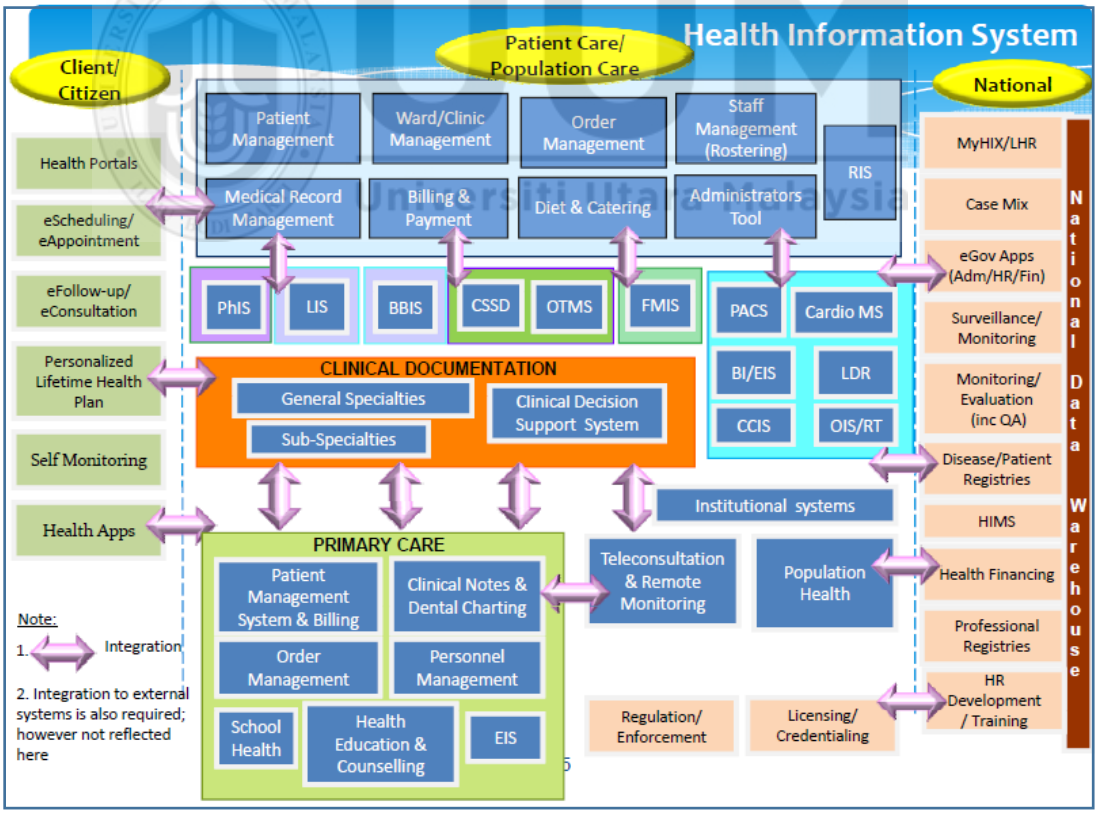

Figure 2.3
Malaysian MOH HERP
Source: Rozita Halina Hussein, Asia Pacific Region, Country Health Financing Profiles: Malaysia, Institute for Health Systems Research (2016)

employee work performance with higher productivity and efficiency. Additionally, national healthcare system transformation under the 11th Malaysia planning (2016-2020) is to restructure national HERP that is responsive and provides high service quality. Malaysian MOH HERP as shown in Figure 2.3 above. Malaysian government allocated 8.62% of the 2016 national budget commensurate to RM23 billion to the Ministry of Health (MOH) for annual operating and development cost.

Table 2.2
Malaysia financial allocation (2016)

Financial Allocation, 2016	
Total MoH Allocation	RM23,031,066,400
- Operating	RM21,430,802,000
- Development	RM1,600,264,400
Per Capita Income[1] (current prices)	RM38,438 (forecast)
Percentage of Total MoH Allocation to National Budget	8.62%

Source: Department of Statistics, Malaysia (2017)

Table 2.3
Malaysia national health accounts (2013 & 2014)

National Health Accounts		
Indicator	2013	2014
Total Expenditure on Health (Public & Private) (in million)	RM44,976[1] (RM44,748)[2]	RM50,278
Total Expenditure on Health as a Percentage of GDP	4.41%[1] (4.53%)[2]	4.54%
Public Expenditure as a Percentage of Total Expenditure on Health	51.86%[1] (51.96%)[2]	52.43%

Source: Department of Statistics, Malaysia (2017)

Furthermore, Malaysia national indicator reported RM50 billion was expended in 2014 nationwide for total expenditure on public and private health services. Thus, the Malaysian healthcare industry is an essential business justified for the researcher to make empirical research contributions. Subsequently, the global demand for healthcare services is predictable to constantly grow in the future due to forecast demographic shifts, among which are the rise in the aging population, life expectancy and lifestyle diseases. Malaysia financial allocation (2016) and Malaysia national health accounts (2013 & 2014) are shown in Table 2.2 and Table 2.3, separately.

2.4.1 Stem cell transfusion medicine

Stem cells are the centre of bone marrow transplants, a method utilised to treat illness, particularly leukaemia. The umbilical cord bloods are stored by freezing the cells in liquid nitrogen, which accepts preservation of the stem cells for many years. In Malaysia, the National Blood Bank in MOH handles cord blood banking for donation purposes whereas few private companies provide the service of cord blood banking:

1. Cryocord Sdn Bhd, laboratory and bank in Cyberjaya.
2. StemLife Berhad, laboratory and bank in Kuala Lumpur.
3. CellSafe International Sdn Bhd, laboratory and bank in Kuala Lumpur.

Statistical Market Research Consulting (2016) claims the global cord blood banking services market is expected to be worth US$19.32 billion by 2022, up from US$12.50 billion in 2015. CGL-SG the consumer healthcare company is shown in Figure 2.4.

Figure 2.4
CordLife Group Limited the consumer healthcare company
Source: CordLife Group Limited Annual Report (2016)

2.4.2 CordLife Group's HERP post-implementation phase issues

CordLife Group's IS department dictates the important role in CordLife Group, particularly to provide continuous IS support service to in-house HERP users while to secure HERP post-implementation success. Therefore, CGL-Singapore's CEO, Dr. Wong Chiang Yin looks for a comprehensive empirical framework that serves as guidelines for upholding numerous implemented HERP. Furthermore, to secure the post-implementation phase of the HERP life cycle, therefore, a pool of in-house IS staff are employed to sustain the HERP usage. Nonetheless, past experiences revealed several issues and challenges need to be addressed, such as what success elements contributed to HERP post-implementation success; how to build the sophisticated HERP, satisfied HERP users, characteristics of know-how of in-house IS staff, particularly on HERP-based services provision. Generally, HERP is projected to generate higher productive, effective and efficient individual users to bring CordLife Group for better total revenues. In the end, the challenges should be resolved by tackling each of the aforementioned jigsaw puzzles while to secure the HERP post-implementation phase.

For the past few years, CordLife Group had budgeted significant amount exceeding millions of dollars on upholding the sophisticated and complicated HERP-based services. According to CGL-Singapore's CEO, the aforementioned HERP operating expenditure (OPEX) should be returned with the adequate level of productivity, effectivity and efficiency of employees otherwise the implemented HERP is considered the failure in technology investments. Therefore, neither the HERP expense allocation

for the implemented HERP nor the HERP capital expenditure (CAPEX) for HERP upgrading expenditure will be approved if past implemented HERP usage is worthless.

CordLife Group focused on the roles from in-house IS staff rather than external IS vendors. The rationales are in-house IS staff provide the 1st tier of human-oriented service quality in the manner of agile, nimble, rapport, understandable, relatively cost-effective and financial-efficient for in-house HERP users. Furthermore, CGL-Singapore's CEO refuses if there are overloaded with IS support service contract binding with external IS vendors which totally jeopardised the flexibility of management on HERP long-term strategic planning. Nonetheless, the thorough practical framework should be developed for IS and preached by each subsidiaries' IS staff upon executing their roles and duties to support existing HERP. The ultimate goal of IS to furnish comprehensive IS support service towards HERP users. Besides service quality aspect, success elements on HERP post-implementation success, particularly the HERP quality, such as hardware and software require a continuous technical support in order to generate an optimum level of SQ and IQ of the HERP.

2.5 Chapter summary

In summary, this chapter stipulated an overview of the HERP post-implementation phase in the Malaysian healthcare industry with a case example of CordLife Group. The chapter discusses the corporate profile of CGL-Singapore, SLB-Malaysia and subsidiaries then CGL-Singapore's accreditations earned in 2010-2016. This chapter explores in-depth about the HERP in Malaysian healthcare industry and CordLife Group exclusively.

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

The idea of this chapter is to stipulate a review of the past literature that relates to the present study and to support the body of existing research. The chapter is classified into three sections. The first section elaborates the IS theories. The second section discusses the underpinning theory of the D&M ISSM (2003) on the research framework applied in the present study. The researcher justified the reasonable explanations to choose the D&M ISSM (2003) after an intensive review of IS literature. Last of all, the literature review exploration on SQ, SVQ, IQ, SAT and IBS.

3.2 IS Theories

Generally, ERP implementation is a complicated process of technological revolution and change management that influences organisations (Sulaiman & Wickramasinghe, 2014). Though ERP success can be difficult to assess, yet numerous ERP studies had examined the critical success factors (CSF) that bring about a successful ERP implementation (Bernroider, Wong & Lai, 2014; Ram, Corkindale & Wu, 2013). The succeeding section deliberates several models that have been applied for IS studies.

3.2.1 Task Technology Fit (TTF)

Chang (2008) determines Task Technology Fit (TTF) model is concerned with the degree to which the outcome of the technology matches the demand of the task. On the other hand, Goodhue (1995) defined TTF as the extent that technological functionality

matches task requirements and individual abilities. Furthermore, TTF model illustrated the factors that influence end users' performance in the ERP environment. More importantly, the IS success factors are Task Characteristics, technology Characteristics, Individual Characteristics and Task Technology Fit (see Figure 3.1).

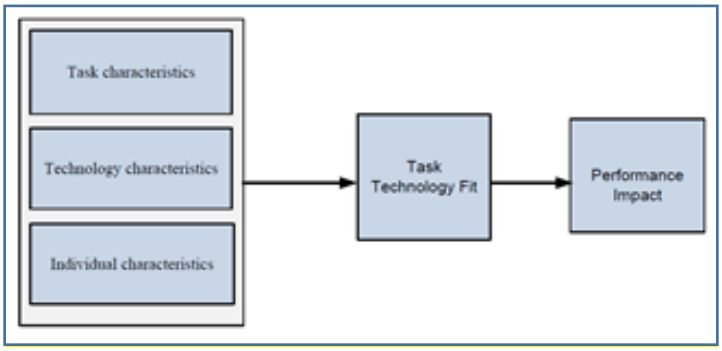

Figure 3.1
The Model of Task Technology Fit
Source: Goodhue (1995)

3.2.2 Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh, Morris and Davis (2003) provided a formulation of the united theory of acceptance and use of technology (UTAUT). In addition, the constructs of age, gender, experience and voluntariness of use moderated the constructs performance expectancy,

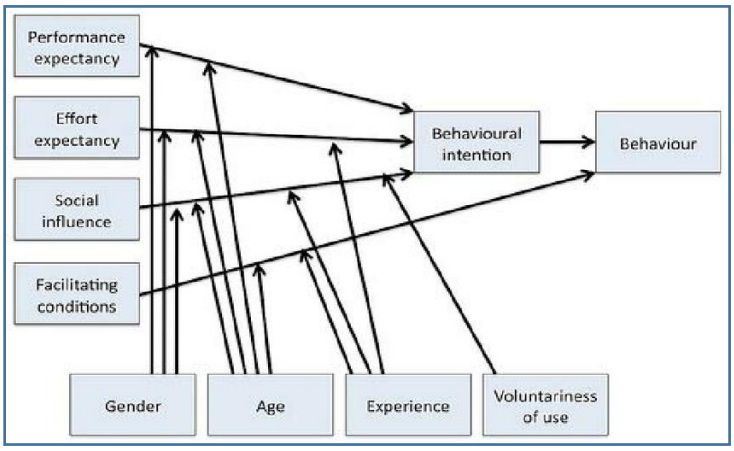

Figure 3.2
The UTAUT Model
Source: Venkatesh *et al.* (2003)

effort expectancy, social influence and facilitating conditions. Whereas, the constructs performance expectancy, effort expectancy and social influences impact behavioural intention, facilitating conditions and behavioural intention affect the use of the IS (Venkatesh *et al*., 2003). Besides, Venkatesh, Thong and Xin (2012) extended UTAUT to UTAUT2 by adding constructs of hedonic motivation, price value and habit.

3.2.3 D&M ISSM (1992, 2003)

The D&M ISSM (1992) incorporates six main types of IS success: SQ, IQ, Use, SAT, Individual Impact and Organisational Impact (see Figure 3.3).

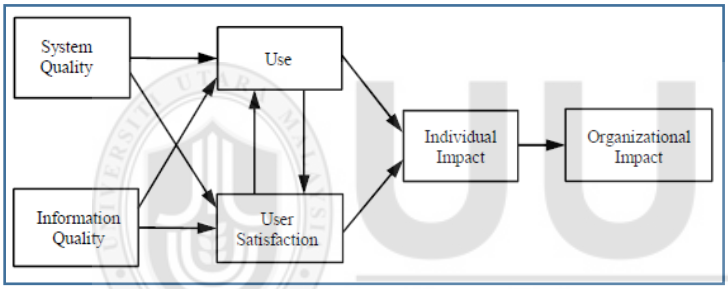

Figure 3.3
DeLone and McLean ISSM
Source: DeLone and McLean (1992)

Intention to Use/Use is presumed to be the foremost indicator of the success of ERP system usage. More importantly, the D&M ISSM (1992) is one of the most cited models in the IS literature. Generally, the model has been utilised to clarify IS success at the individual level and the organisational level of analysis. However, the D&M ISSM (2003) is an updated version of the D&M ISSM (1992), which added SVQ and collapsed Individual Impact and Organisational Impact into Net Benefits. Essentially, SVQ is incorporated as a central element of IS success given the importance of IS support. In addition, SVQ is the quality of support that system users receive from the IS department and IS support staff. Eventually, the SVQ includes factors, such as

Responsiveness, Accuracy, Reliability, Technical Competence and Empathy of the IS staff (D&M, 2003). In a nutshell, Figure 3.4 depicts the updated D&M ISSM (2003).

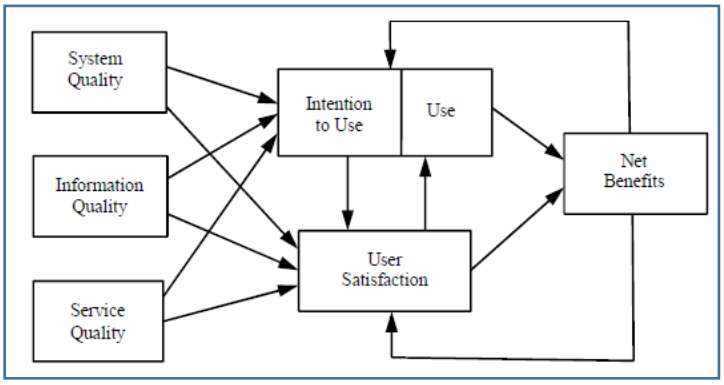

Figure 3.4
DeLone and McLean Updated ISSM
Source: DeLone and McLean (2003).

3.3 Underpinning theory: D&M ISSM (2003)

In general, an underpinning theory is used to facilitate in better understanding the perception behind the phenomenon under investigation. In addition, the theory also provides a representation of the logical linkage between various constructs or concepts, allowing better interpretation of the relationship between them and how they affect each other (Zikmund, 2003). On the other hand, among the above discussed IS theories, the D&M ISSM (2003) is the most appropriate for the present study setting. Firstly, the D&M ISSM fitting the requirement to develop a proper framework wherein consists of several potential success elements for assessing HERP post-implementation success. Secondly, the D&M ISSM is the most cited IS theory in top-tier IS journals related to HERP's successful model (Sulaiman & Wickramasinghe, 2014). Thirdly, the D&M ISSM spelled out the SVQ as the important success element that overlooked by other IS theories. In addition, SERVQUAL the prominent and established instrument from marketing field is adopted to produce a more applicable D&M ISSM for the

present study. In accordance, this study considers the D&M ISSM (2003) as the present study's underpinning theory that governs the proposed research framework. However, the construct of Intention to Use/Use are dropped due to irrelevant to the context of present study which focused on HERP post-implementation success.

Building on the D&M ISSM (2003), the HERP post-implementation success model as multi-dimensional by the focal point on SVQ, with the aim to make knowledge gap contributions to the IS practitioners and literature in the healthcare industry. Despite the fact that Hsu, Yen and Chung (2015) had studied on the role of SVQ and proposed Extended Use variable by examining 151 ERP users in Taiwan manufacturing industry. Nevertheless, the researcher advances IS knowledge by interpreting the research findings to an empirical framework; the role of SVQ in HERP post-implementation success in the healthcare industry by specialising in a case example of CordLife Group. Essentially, the aforementioned empirical framework foreseeable to spell out the determinants, such as HERP qualities and in-house IS staff's SVQ to fulfilling SAT and IBS which becomes a critical organisational issue for the success of their costly HERP post-implementation. Ultimately, the framework can serve as guidelines for healthcare industry IS practitioners like IS managers to further advance their HERP management and supervision skill on human-oriented IS support service.

3.3.1 Relationship of D&M ISSM (2003) with the present study model

Past studies on ERP post-implementation accomplishment been reviewed extensively. As summarised in the review table (see Table 3.1), the majority of prior studies had scrutinised ERP post-implementation accomplishment at the firm level. Thus, the

Table 3.1

Previous studies on ERP post-implementation success

No	Author	Journal	Year	Theory	Main Results (HERP post-implementation performance)
					Firm Level:
1	Gattiker and Goodhue	*MIS Quarterly*	2005	Organisational Information Processing Theory	ERP could deliver intangible benefits to firms: Better information, more efficient internal business process and better coordination between different units of the firm.
2	Galy and Sauceda	*Information & Management*	2014	No specific theory is issued	Increased technological competence effects net sales, relationships with outside experts affects earnings, return-on-assets and return-on-investment, top management support affects net sales and net income, long-range planning negatively affects earnings and the sharing of information between departments affects net income, return-on-assets and return-on-investments.
3	McGinnis and Huang	*Information & Management*	2007	ERP continuous improvement phase model & knowledge spiral model	Incorporation of knowledge management into firms' ERP post-implementation improves success rates of ERP systems.
					Individual Level:
4	Sykes *et al*.	*MIS Quarterly*	2014	Social Network Theory	This study investigates employees' ERP post-implementation job performance. Workflow advice and software advice are associate with employee job performance.
5	Morris and Venkatesh	*MIS Quarterly*	2010	Job characteristics model	ERP System implementation moderated the relationships between three job characteristics (skill variety, autonomy and feedback) and job satisfaction.
6	Ke *et al*.	*Journal of Management Information Systems*	2012	Self-determination theory	Autonomous job design and socialization tactics could trigger ERP users' intrinsic motivation to explore ERP features.
7	Broudreau	*Proceedings of HICCS*	2003	Grounded theory	Learning is a key factor influencing ERP users' "quality of use" (*i.e.*, limited use and extended use).
					Individual and Firm Level
8	Sasidharan *et al.*	*Information Systems Research*	2012	Social network theory and DeLone-McLean model	Firm level: centralized structures inhibit ERP implementation success Individual level: high in-degree and betweenness centrality reported high task impact and information quality.
9	Sedera and Tan	*Proceedings of PACIS*	2005	DeLone-McLean IS success model	User satisfaction is measured and tested with 16 instruments
10	Tsai, Shaw, Fan, Liu, Lee and Chan	*Decision Support Systems*	2011	DeLone-McLean IS success model	The results reveal causal relationships among system providers, implementation consultants, project management and performance (system quality, information quality, system use, user satisfaction, individual and organisational impacts).
					Performance at Individual Level
11	Pei-Fang Hsu, HsiuJu Rebecca Yen, Jung-Ching Chung	*Information & Management*	2015	DeLone-McLean IS success model	Service Quality in conjunction with system quality and information quality significantly affects ERP post-implementation success in terms of extended use and satisfaction.

Note: This table includes ERP studies that are published in major IS journal *(MIS Quarterly, Information Systems Research, Journal of Management Information System, Journal of Association for Information Systems, Information and Management, Decision Support Systems)* and main IS conference (ICIS, HICCS, ECIS, AMCIS, PACIS) which are identified using keywords such as enterprise resource planning, ERP, enterprise systems, post-implementation and system success.

research outcome variables, such as firms' profits, product quality, market value, organization productivity, process efficiency and shareholder return. However, very few studies were conducted on HERP post-implementation at the individual user level (Sulaiman & Wickramasinghe, 2014). For example, Sykes *et al*. (2014) investigated ERP user's job performance at post-implementation is predicted by software workflow. Whereas, Sasidharan *et al*. (2012) discovered that individual user's post-implementation performance was impacted by the user's social network relationship. In addition, an individual user at system usage was a predictor of ERP post-implementation success in association with job design (Ke *et al*., 2012). In a few words, these studies have evolved the researcher's perception of HERP post-implementation success at the individual user level.

In fact, past studies focused on a single or only a few success constructs which consequently affect fragmented comprehension in the IS literature. Therefore, Gable *et al*. (2008) urged the need to re-conceptualise the D&M ISSM (2003) to bridge the aforementioned literature gap. However, Gable *et al*. ISSM (2008) studies had overlooked the implemented ERP success evaluation at the individual user level. Firstly, the ISSM did not include SVQ which has an important factor cited by D&M (2003). Secondly, the ISSM measures success at the organisational level and has omitted SAT that is an important determinant to individual users who embraced the ERP. Lastly, the interrelationships among the success measures remain unknown.

D&M ISSM (2003) provides an integrative model which the researcher can comprehend ERP post-implementation success by re-evaluating more than 100 success

elements applied to 180 research for meanings of IS success elements (Sulaiman & Wickramasinghe, 2014). Subsequently, the ISSM can be translated as follows: an ERP can be assessed by three quality dimensions like SQ, SVQ and IQ. Similarly, SQ and IQ indicate the resources derived from the ERP which are technology-oriented; whereas SVQ could signal the resources organised by the in-house IS staff to influence ERP users which are totally human-oriented. The previous meta-analysis signifies that SVQ has gathered scant research consideration (Petter & McLean, 2009). Nonetheless, human-based SVQ is proven by the presence of ERP's SQ and IQ (Cao *et al*., 2013; Ha & Ahn, 2014). Few studies have tested human-based SVQ yet their attention lies on service delivered by the ERP vendors or professionals (Tsai *et al*., 2011). Concisely, these discoveries indicate abundant work is required to learn how SVQ of in-house IS staff simultaneously with ERP qualities toward the success of the implemented ERP. Among several studies, Hsu *et al.* (2015) stood out as they indicated the role of SVQ variable as a moderating effect and make the contribution to extending ISSM with a new variable of Extended Use instead of Use in the D&M ISSM (2003).

3.4 Individual benefits

This study's dependent construct is IBS that important for analysis as employees of the organisation are resources that contribute to overall organisational business performance. Whereas the key objective of the organisation is to capitalise on profits, therefore, there is a necessity to comprehend that profits are made from productive employees. Hence, a successful implemented HERP contributes to better IBS, it is likely favourable impact on the organisational business performance (Snead, Magal, Christensen & Amadi, 2015). Therefore, this study investigates the individual user

level that is employee benefits rather than organisational profits. The assessment of the implemented HERP at the individual user level is essential while it's not limited to rationalise the investments yet also stipulates comprehensions about how to improvise employees' behaviour (Poba-Nzaou, Uwizeyemungu & Paré, 2014).

3.4.1 Definition of individual benefits

IBS refers to the influence of information on the individual performance of the recipient (D&M, 1992). In addition, the level to which the HERP has delivered impact on the users' capabilities and effectiveness (Hsu *et al*., 2015). In this study, IBS is the user's perception of the significance and practical of the HERP which has affected their work capabilities and effectiveness.

3.4.2 Concept of individual benefits

Generally, user capability benefits from HERP is defined as the benefits of a further competent fit in performing user's works and improving employee productivity gained from HERP usage. Whereas, user effectiveness benefits from HERP is defined as the benefits of better management of user's works and fulfilling business process objectives benefited from HERP usage. Briefly, IBS in terms of capability and effectiveness benefits led to increase employee productivity, innovation and SVQ (Qutaishat *et al*., 2013). Concisely, the concept of IBS at HERP individual user level break into two categories, which characterise the significant areas of user impact from HERP at post-implementation phase:

1. User capability benefits from HERP
2. User effectiveness benefits from HERP

The issue of intensifying HERP users' benefits in terms of capability and effectiveness of work tasks is essential for the organisation investing in HERP. Hence, recognising what factors influence HERP users' benefits become critical for the organisation.

3.4.3 Measurement of individual benefits

Generally, the 4-item scale established by Tansley *et al.* (2001), Alshibly (2011) and Hsu *et al.* (2015) is adopted to measure IBS. Briefly, IBS refers to the level to which the HERP has given the impact on the individual users' capabilities and effectiveness within the organisation. Particularly, the measurement of IBS is verified by whether HERP influenced users' learning, awareness/recall of job-related information, decision effectiveness and individual productivity. Furthermore, the researcher conceived IBS as a reflective construct as Jarvis *et al. (*2003) admitted, changes in the reflective measures cause changes in the underlying construct. Therefore, changes in each measure of IBS will cause changes in the user's perceived benefits who using the HERP and as a result, the measures of IBS are operationalised as reflective.

3.5 User satisfaction

Several scholars have proposed a few indicators of HERP post-implementation success, such as system use, SAT and HERP performance. Among these, SAT has emerged as the most widely used single indicator of the ISSM (Petter, D&M, 2008). Essentially, the scholars keep continuing to explore the antecedent and consequent of the SAT that able to fit in today's business undertaking (Albayrak & Caber, 2015). Whereas, the role of SAT still remains a central tendency of the marketing concept for the relationship between pre-consumption and post-consumption (Ameer, 2014).

Subsequently, SAT was deliberate as the core of business performance, profitability and competitive advantage (Yeung, Ramasamy & Paliwoda, 2013). Past researchers had identified several determinants of satisfaction like SVQ, which is referred to the human-oriented SVQ from the in-house IS staff within an organisation (Rajaratnam, Munikrishnan, Sharif & Nair, 2014).

3.5.1 Definition of user satisfaction

In general, the basic interpretation of SAT within the past literature was an assessment process between a "pre-consumption expectation" and the "post-consumption perceived performance" by comparing both aspects by organisational employees, for example HERP users. The essential construct in the context of HERP to assess the ISSM is the SAT and this is extensively utilised to measure the success of HERP (Montesdioca & Macada, 2015). Nonetheless, Wang and Lai (2014) defined it as the degree to which HERP users are satisfied with the speed, functions, quality and format of HERP. Subsequently, Ogara *et al*. (2014) look at it as the perceived affective reactions of a respondent to the IS. In this study, SAT defined as recipient feedback to the consumption of the output from HERP or the level to which users experience the HERP fulfils their necessities (D&M, 1992).

3.5.2 Concept of user satisfaction

The conceptualisation of the SAT was verified in various behaviours to suit with the context of research undertaken. Applying the right concept of the SAT is important to avoid any distraction of performance result or outcome from the users of the target group. Essentially, the two approaches, namely transaction specific and cumulative

satisfaction approach are still applicable in recent studies throughout the various industries. SAT concept under the process based is reflected several attribute judgments related to a particular transaction which known as transaction-specific satisfaction (Koufteros, Droge, Heim, Massad & Vickery, 2014; Loureiro *et al*., 2014). Additionally, in a transaction-specific satisfaction, users make an assessment or judgment at a particular time during the service encounter or consumption situation (Koufteros *et al*., 2014). In this concept, the performance of service is a primary effect on satisfaction level and proposes a better predictor to further processing like behavioural intention. However, the cumulative satisfaction concept is preferable and consistent in HERP context (Loureiro *et al.,* 2014). The cumulative satisfaction concept is applied in the present study because of it more suitable with the proposed scope of population and more superior prediction (Loureiro *et al*., 2014).

3.5.3 Measurement of user satisfaction

Generally, there were two prominent types of scale applied to the measurement of the SAT, a single item and multiple items. Whereas, some researchers like Shin and Elliot (2001), used a single item rating scale of four to seven points for measuring overall satisfaction as a simple basis assessment to reflect "very satisfied" to "very dissatisfied". Furthermore, most of SAT measurement was developed to simply assess on the global or net satisfaction with post-consumption of product and service (Shin & Elliot, 2001). However, recent studies indicated the scholars are more inclined to use a multiple-item scale compared to a single-item scale. Essentially, a multiple-item scale has been viewed able to represent a various component of the SAT, such as general satisfaction, affective response, cognitive response, disconfirmation, fulfilment of need

and also value. Essentially, the measurement of SAT used in recent years studies is shown in Appendix A.

3.6 System quality

SQ is a very important variable within ISSM that contribute to the SAT and IBS in the present study. Thus, SQ is the user assessment of system performance when delivering information and fulfilling user needs (Yoo & Kim, 2015). Furthermore, an advanced IS like HERP has been intensely induced by SQ. Concisely, HERP is stimulated by operating systems that control both its hardware and software resources. Subsequently, these operating systems regulate SQ, which is significant in the HERP context.

3.6.1 Definition of system quality

Essentially, SQ characterises the quality of the HERP processing that comprises of software and data elements. In addition, it is a measure of the level to which the HERP is technologically viable (Yoo & Kim, 2015). Therefore, the D&M ISSM (2003) consider SQ as the main dimension which constitutes the desirable characteristics of the HERP, such as system usability. Furthermore, Yoo and Kim (2015) studies had validated the D&M ISSM (2003), particularly on SQ variable. In the present study, SQ refers to measures of the HERP, the quality of the HERP performance from a technical perspective (D&M, 2003; Gable *et al*., 2008; Hsu *et al.*, 2015; Nelson *et al*., 2005).

3.6.2 Concept of system quality

From the previous IS literature, seven items were identified to measure SQ that covered accessibility, flexibility, functionality, system accuracy / reliability, ease of

use, integration and navigation as the main characteristics of SQ. Wang and Lai (2014) state the definition of SQ is the level to which the HERP users are convinced by the criterion of the HERP is comfortable to use, user-friendly, excellent for learning, simple to access and joyful.

3.6.3 Measurement of system quality

Generally, SQ is classified into (1) system-related dimensions and (2) task-related dimensions that measured through the 7-item scale (D&M, 1992; Gable *et al*., 2008; Hsu *et al.*, 2015; Nelson, Todd & Wixom, 2005). Whereas, system-related dimensions measured the characteristics that are constant across different uses and independent of task, context or application, for example accessibility and reliability. Meanwhile, task-related dimensions measured the characteristics that rely on the particular task and setting, for example flexibility, response time and integration (Nelson *et al*., 2005). Therefore, users should capable to experience an established HERP, for example accessibility, reliability and recognise the HERP helpful upon accomplishing their jobs, motivated to extend the usage of the HERP functions and features.

3.6.4 The relationship between system quality and user satisfaction

In general, high SQ of HERP leads to high SAT (Chen, Jubilado, Capistrano & Yen, 2015). SQ also performs a key role in the underlying HERP-based services and SAT, for example, users are refusing to utilise the HERP-based services when they encounter many response delays, disconnections, unavailability of access or weak security (Shin, 2014). It can be acknowledged that both SQ and SAT are equally important. Furthermore, both the D&M ISSM (2003) and prior research, for example, Chen,

Jubilado, Capistrano and Yen (2015) argue a positive relationship among SQ and SAT and this finding has been tested by many empirical studies.

3.7 Information quality

Essentially, IQ refers to the measures of the HERP output, for example the quality of information the HERP generates, principally in the mode of reports or screens (D&M, 1992; Gable *et al*., 2008). Mohammadi (2015) regarded IQ as the level to which HERP users are convinced that information is up-to-date, accurate, applicable, comprehensive and systematised. Whereas, Wang and Lai (2014) argued that IQ as the level to which HERP users are convinced that information is logical, accurate, sufficient, timely and meets needs.

3.7.1 Definition of information quality

IQ is the user assessment of system performance when providing information and fulfilling user needs (Yoo & Kim, 2015). Nonetheless, Rana, Dwivedi, Williams and Lal (2015) claim that IQ as the relevance, reliability and timeliness of knowledge provided by an IS. Additionally, the term IQ has been used interchangeably with content quality. As HERP has become adequately complex to consist of various contents, numerous studies have employed IQ (Ghasemaghaei & Hassanein, 2015). In the perspective of the present study, the researcher defines IQ as measure the characteristics of information provided by the HERP.

3.7.2 Concept of information quality

Accordingly, COBIT 4.1 (Control Objectives for Information and Related Technology) addresses the criteria of IQ as consisting of efficiency, confidentiality, integrity, availability, compliance, effectiveness and reliability concepts. Agreeing to the D&M ISSM (2003), the five items to measure IQ, namely accuracy, timeliness, completeness, relevance and consistency are incorporated in IQ dimension in this study. In addition, IQ is involved with matters, such as the relevance, timeliness and accuracy of the information produced by HERP (D&M, 2003; Ghasemaghaei & Hassanein, 2015).

3.7.3 Measurement of information quality

In a few words, IQ is categorised into (1) context and (2) representation dimensions that measured through the 5-item scale (Gable *et al*., 2008; Hsu *et al*., 2015; Nelson *et al*., 2005). The context dimension signifies the quality of information that HERP generate for users. In addition, the foremost measurement is the accuracy of information, whether the information is accurate, updated and consistent. Also incorporated in this dimension is the level to which the information is helpful, relevant, complete and current. On the other hand, the representation dimension, reveals the level to which information presentation is good and understandable; Furthermore, the foremost measurement is the format (Nelson *et al*., 2005).

3.7.4 The relationship between information quality and user satisfaction

Wang and Lai (2014) determined that one of the essential factors that influence SAT is IQ. High quality of information leads to higher SAT (Chen, Jubilado, Capistrano & Yen, 2015). Numerous investigations discovered that IQ had a positive significant

relationship with SAT (Ghasemaghaei & Hassanein, 2015). Furthermore, Wang and Lai (2014) revealed that IQ has a positive effect on SAT in their quantitative study which questioned 295 employees and the findings supported by Cho *et al*. (2015). However, Ghobakhloo and Tang (2015) in a survey of 400 business executives, argued the opposite that IQ does not predict SAT.

3.8 Service quality

In actual fact, SVQ played a pivotal role in business service delivery. Thus, high SVQ will lead to high SAT (Han & Hyun, 2015; Suki, 2014). However, poor SVQ will cause the user's low productivity (Lovelock, Patterson & Writz, 2011). Therefore, it is essential to IS managers to understand the requirement of their HERP users and able to adjust their services according to the needs of HERP users (Vanniarajan & Gurunathan, 2009). Hence, Purcărea, Gheorghe and Petrescu (2013) suggest that a persistent investigation of the user expectations and perceptions is needed to ensure a long survival of SVQ from in-house IS staff. The right assessment of SVQ will assist IS managers to identify opportunities, weakness, close the SVQ gaps and organisational resources will be precisely distributed where there is a necessary need.

3.8.1 Definition of service quality

For the most part, D&M (2003) adapted SERVQUAL; an instrument developed by Parasuraman, Zeithmal and Berry (1988) for assessing SVQ into the IS field which incorporates the succeeding five dimensions: Tangibility (TAN), Reliability (REL), Responsiveness (RES), Assurance (ASS) and Empathy (EMP). According to Han and Hyun (2015), SVQ is the assessment of how good a conveyed service fulfils to users'

expectations. In this study, SVQ is the quality of services conveyed by the in-house IS staff to HERP users; assessed based on the aforementioned five dimensions.

3.8.2 Concept of service quality

The concept of SVQ has been stressed intensively in marketing studies since the concept is so important and act as the main determinant to SAT but it is subjected to the type of industries (Wu, 2014) and type of service setting (Sandhu & Bala, 2011). Generally, there were two key schools of thought leads the SVQ literature like Nordic school is referred to Grönroos (1984) and American school is referred to Parasuraman *et al*. (1988) of five dimensional SERVQUAL model (Caro & Garcia, 2008). The SVQ model was developed by Grönroos (1984) which comprises three dimensions, namely technical quality, functional quality and image. The technical and functional service quality model is depicted in Figure 3.5.

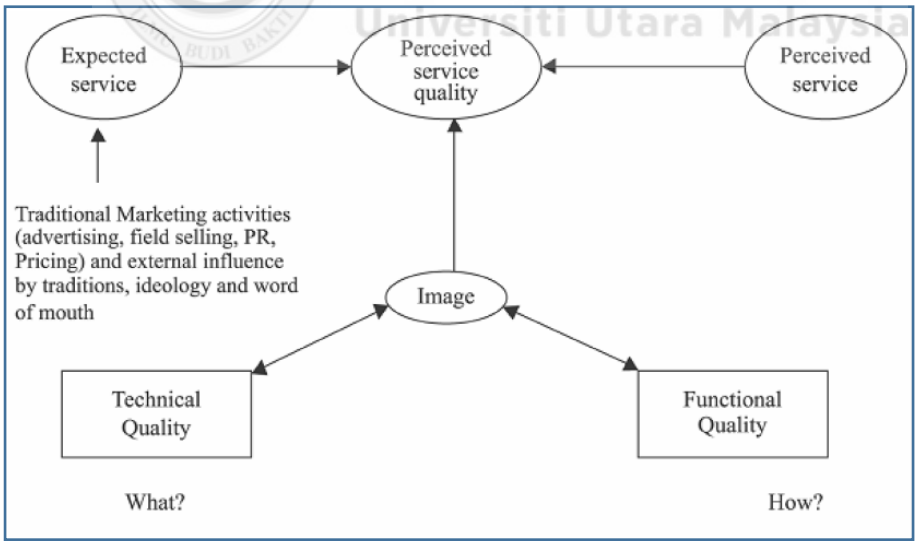

Figure 3.5
Technical and functional service quality model
Source: Grönroos (1984)

Parasuraman *et al*. (1988) propose five dimensions with twenty-two items and named it as SERVQUAL model. SERVQUAL was the most referred concept and validated scales across a variety type of service industries (Ahmad, Ihtiyar & Omar, 2014). The SERVQUAL model was considered as a multi-dimensional construct consists of five dimensions, namely Tangibility, Reliability, Responsiveness, Assurance and Empathy. The definition of five dimensions of SERVQUAL was defined in Table 3.2.

Table 3.2
Definition of SERVQUAL dimensions

Dimension	Definition
Tangibility	Physical facilities, equipment and appearance of personnel.
Reliability	Ability to perform the promised service dependably,
Responsiveness	Willingness to help users and provide prompt service.
Assurance	Knowledge and courtesy of employees and their ability to inspire trust and confidence.
Empathy	Caring, individualised attention the firm provides its users.

Source: Parasuraman *et al*. (1988)

SVQ was considered as highly complex in nature (Dhar, 2015). In reviewing Brady and Cronin (2001) study, SVQ concepts of the Nordic school and the American school models were integrated into a new hierarchical model. In Brady and Cronin's model suggests SVQ model that consists of three dimensions, namely interaction quality, physical environment quality and outcome quality. All the dimensions in a hierarchical model comprise of three sub-dimensions and the cumulative assessment of the sub-dimensions represent the experience of that particular dimension that leads to the overall perception of SVQ. The Brady and Cronin's conceptual model are depicted in Figure 3.6. In this study, the concept of SVQ based on American school of thought refers to Parasuraman *et al*. (1988) of five dimensional SERVQUAL model.

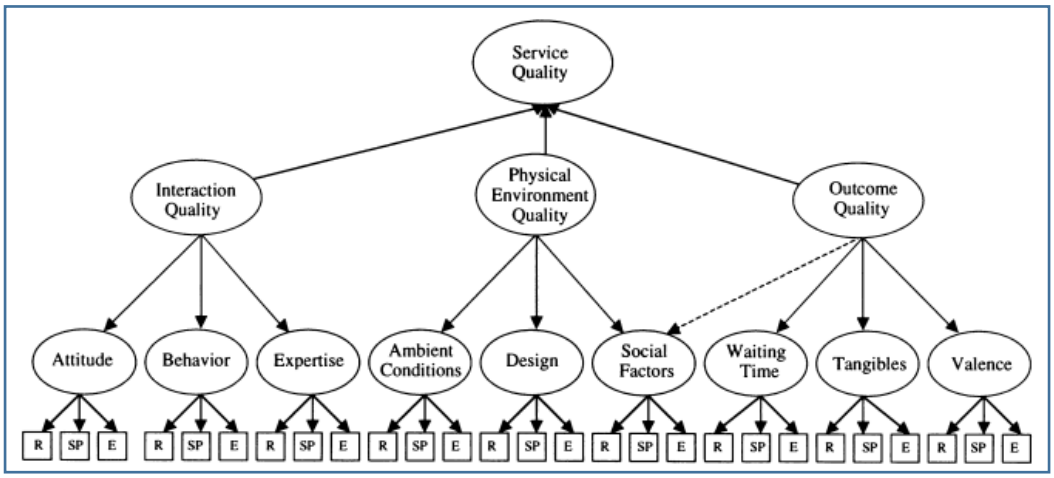

Figure 3.6
A hierarchical approach of perceived service quality
Source: Brady & Cronin (2001)
Note: R = a reliability item, SP = a responsiveness item, E = an empathy item. The broken line indicates that the path was added as part of model re-specification.

3.8.3 Measurement of service quality

Measuring SVQ is a complicated task, varieties of instruments were established to measure quality in the specific services industry. For example, SERVQUAL (Parasuraman *et al*., 1988) for financial institutions, repair and maintenance company and telecommunication; SERVPERF (Cronin & Taylor, 1992, 1994) for hotels, clubs and travel agencies; DINESERV (Stevens, Knutson & Patton, 1995) for food and beverage establishments; LODGSERV (Knutson, Stevens & Yokoyama, 1990), LODGQUAL (Getty & Thompson, 1994) and HOLSERV (Mei, Dean & White, 1999) for hotels. The view of Han and Hyun (2015) study had affirmed that SERVQUAL had received the most attention compared to another instrument of SVQ and it also had been recognised as being the most extensively used instrument for assessing SVQ (Albacete-Sa´ez, Fuentes-Fuentes & Llore´ns-Montes, 2007; Stodnick & Rogers, 2008) in service management and marketing literature (Stodnick & Rogers, 2008). The components represent five dimensions in SERVQUAL are listed in Table 3.3.

Table 3.3
Components of SERVQUAL dimensions

Dimension	Definition	Components
Tangibility (TAN)	Physical facilities, equipment and appearance of personnel.	Equipment, physical facilities and employee appearance.
Reliability (REL)	Ability to perform the promised service dependably.	Promise, problem solving, service dependable, timely and record accuracy.
Responsiveness (RES)	Willingness to help users and provide prompt service.	Information to the user, prompt service, willingness to assist and spend time.
Assurance (ASS)	Knowledge and courtesy of employees and their ability to inspire trust and confidence.	Trust, safe transaction, polite and adequate support for employee's performance.
Empathy (EMP)	Caring, individualised attention the firm provides its users.	Attention from firm and employee, awareness of user's needs, user's interest and convenience operating hours.

Source: Parasuraman *et al*. (1988)

D&M (2003) adopted SERVQUAL; an instrument established by Parasuraman *et al.* (1988) for assessing SVQ, apply in the IS field. In this study, the researcher adopted SVQ measures from previous studies (Hsu *et al.,* 2015; Parasuraman *et al.,* 1988; Pitt, Watson & Kavan, 1995), where a 22-item scale is utilised to describe the five dimensions of SVQ: Tangibility, Reliability, Responsiveness, Assurance and Empathy. Thus, SVQ should be a formative and higher-order construct because the dimensions produce the total perception of SVQ (Parasuraman *et al.,* 2005). In addition, SVQ as a second-order formative constructs formed by the five first-order dimensions, whereas the first-order dimensions are operationalised as reflective constructs. Mostly, the validity of the hierarchical or higher-order construct model is confirmed through the structural equation model using Analysis of Moment Structures (AMOS), Partial Least Square (PLS) or LISREL statistical software. Table 3.4 shows the list of hierarchical concepts that applied in recent years studies.

Table 3.4
The list of hierarchical concepts applied in recent years studies

No.	Source	Year	Research Context	Method	Service Quality Model	Dimensions
1	Wu, Li & Li	2014	Theme Parks, Taiwan	PLS-SEM Formative	Adapted from Brady & Cronin's Hierarchical model	Interaction Quality, Physical environment quality, Outcome quality, Access quality, Overall experiential quality.
2	Rajaratnam *et al*.	2014	Rural tourism destinations in Malaysia	PLS-SEM Formative	Adapted from SERVQUAL (perceived service only)	Accessibility & Logistics, Core Tourism Experience, Hygiene, Information, Security, Value for money, Hospitality.
3	Wu & Li	2014	Historic Centre of Macau, China	SEM-AMOS Reflective	Adapted from Brady & Cronin's Hierarchical model	Interaction Quality, Physical environment quality, Outcome quality, Access quality, Overall experiential quality.
4	Clemes *et al*.	2014	Mobile Communication service, China	PLS-SEM Reflective	Adapted from Brady & Cronin's Hierarchical model	Interaction Quality, Physical environment quality, Outcome quality.
5	Howat & Assaker	2013	Outdoor aquatic centers, Australia	PLS-SEM Formative	SERVPERF	Core services, Secondary services, Staff.
6	Ganguli & Roy	2013	Retail banking, India	SEM-AMOS Reflective	Adapted from Brady & Cronin's Hierarchical model	Interaction quality, Technology quality, Auxiliary quality.
7	Untachai	2013	Hospital services, Thailand	SEM-LISREL Formative	Adapted from SERVQUAL (perceived service only)	Tangibility, Responsive, Reliability, Assurance, Empathy.
8	Wu & Cheng	2013	Airport industry, Taiwan	SEM-AMOS Reflective	Adapted from Brady & Cronin's Hierarchical model	Interaction Quality, Physical environment quality, Outcome quality.
9	Wu & Ko	2013	Tourist Hotel, Taiwan	SEM-AMOS Formative	Adapted from Brady & Cronin's Hierarchical model	Interaction Quality, Physical environment quality, Outcome quality.
10	Clemes *et al*.	2013	Public university, China	SPSS Formative	Adapted from Brady & Cronin's Hierarchical model	Interaction Quality, Physical environment quality, Outcome quality.

Note: PLS = Partial Least Squares; AMOS = Analysis of moment structure; SEM = Structural Equation Modelling.

3.8.4 The relationship between service quality and user satisfaction

An extensive attention in the service literature has been given to the connection between SVQ and SAT (Izogo & Ogba, 2015; Rajaratnam *et al*., 2014). Thus, SVQ plays a crucial role to attain competitive advantage lies in delivering high SVQ that able to effect in SAT (Meidutė-Kavaliauskienė, Aranskis & Litvinenko, 2014). However, several studies have presented consistent evidence on the direct and positive relationships between SVQ and SAT, such as studies carried out by Han and Hyun (2015), Kashif, Shukran, Rehman and Sarifuddin (2015) and Rajaratnam *et al*. (2014).

Several scholars had examined the direct relationship effect between each dimension of SVQ to SAT. For example, quantitative findings by Munusamy, Chelliah and Mun (2010) on SVQ delivery and its influence of the SAT in the banking industry in Malaysia exposed that Assurance, Empathy, Reliability and Responsiveness dimension have a relationship but it has no significant influence on the SAT. The Tangibility dimension has a positive relationship and has a significant influence on the SAT. The outcome the analysis is not congruent to findings by Kashif *et al*. (2015) in Malaysia Islamic banks using PAKSERV which adapted from SERVQUAL scale where Tangibility, Assurance, Sincerity, Personalisation and Formality dimension have a significant relationship with SAT but not Reliability. While, Kitapci, Akdogan and Dortyol (2014) in public healthcare service had discovered Assurance, Empathy and Responsiveness dimension have a significant relationship with SAT but not Tangibility and Reliability. While, Izogo and Ogba (2015) study had found that all SERVQUAL dimensions were significant to SAT and the result proves the instruments applied to measure SVQ was highly reliable and valid. But, the inconsistent result of the

SERVQUAL dimensions in past studies may be as a result of the cultural differences (Izogo & Ogba, 2015).

From the above literature, although there were several approaches to measuring SVQ, such as multi-dimensional, unidimensional and hierarchical model, SVQ still remains as a significant construct to SAT. This is due to the nature of SVQ and SAT relationship which was seen as linear, showing that the high SVQ performance may result in high response of the SAT.

3.9 Chapter summary

Briefly, SQ, SVQ, IQ, SAT and IBS are introduced and discussed by reviewing the existing IS literature. Subsequently, several empirical studies are reviewed and discussed in order to provide relevant evidence to support the discussion. Thus, this chapter also discusses the underpinning theory on the D&M ISSM (2003) that governs the proposed research framework of this study. Last but not least, the reviews form a foundation for the research framework and hypotheses development which are discussed in the succeeding chapter.

CHAPTER FOUR

METHODOLOGY

4.1 Introduction

This chapter provides a description of how the research was carried out and the methodology employed to test the hypotheses. The chapter is classified into eight sections. The first section elaborates the present study's research framework. The second section discusses the development of hypotheses. The third section presents the research design of this study. The fourth and fifth section discusses the operationalisation and measurement of variables subsequently followed by data collection. The sixth section highlights the technologies of data analysis subsequently the seventh section is related to a pilot study. Lastly, the chapter ends with a summary.

4.2 Research framework

A research framework is the application of a theory or concepts to guide researchers, determine what things to be measured and offer clarification of an occasion or shed some light on a particular research problem (Imenda, 2014). This study's research framework is depicted in Figure 4.1. Essentially, this study was to examine the relationships among potential success elements, namely System Quality (SQ), Service Quality (SVQ), Information Quality (IQ), User Satisfaction (SAT) and Individual Benefits (IBS). Subsequently, a framework for assessing HERP post-implementation success was developed. Despite the fact that Hsu *et al.* (2015) had studied the role of SVQ in the context of ERP but their study focused on examining 151 ERP users in Taiwan manufacturing industry. On the other hand, the present study advances IS

knowledge of the healthcare industry by interpreting the research findings to an empirical framework; the success elements in the D&M ISSM on HERP post-implementation success in the healthcare industry through a case example of CordLife Group. Meanwhile, SQ and IQ are formed by two elements, respectively. Additionally, SVQ construct is formed by five dimensions while IBS construct is an outcome in this study's research framework.

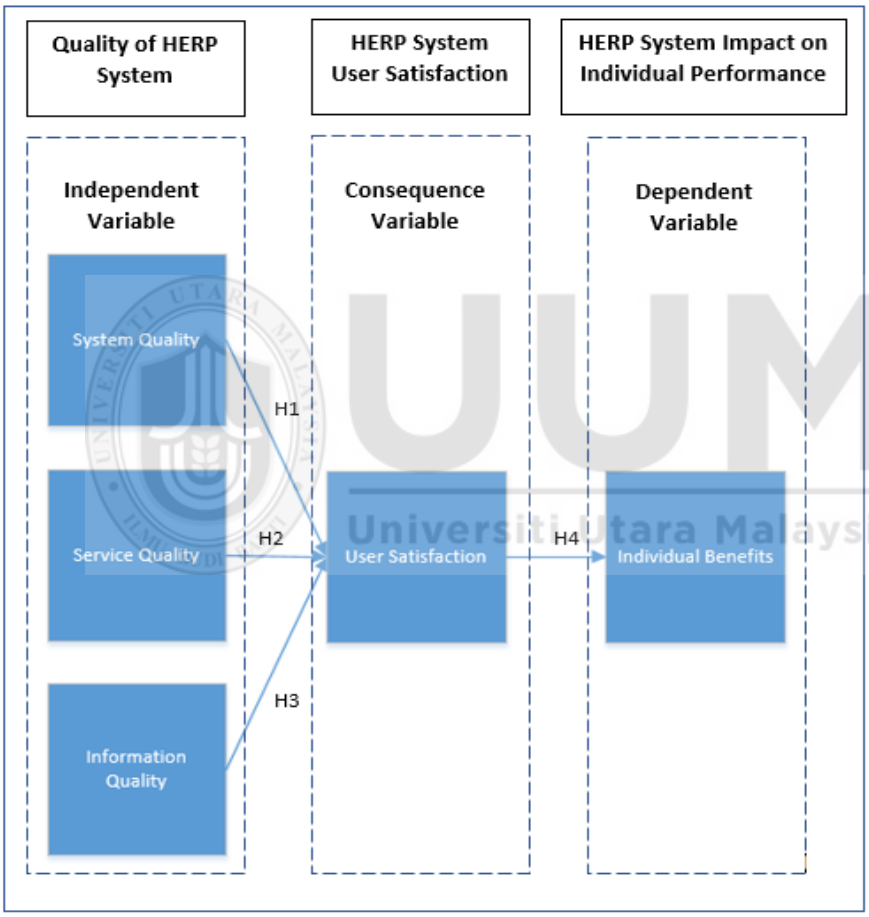

Figure 4.1
Research framework

Subsequently, testable hypotheses could be developed to validate the theory formulated (Sekaran, 2003). Based on the aforementioned research framework, four hypotheses represented by H1 to H4 had been proposed. The hypotheses to support the relationship between the constructs as discussed in the following subheading.

4.3 Hypotheses development

Essentially, the hypotheses of the present study are formulated from the research framework as shown in Figure 4.1 above and supported by the D&M ISSM (2003). The formulation of hypotheses is expected to be true and responded to the stated research objectives of the present study. The items included in this study questionnaire have corresponded to all hypotheses. The present study postulates the dependent variable of IBS is influenced by SAT. HERP qualities and SVQ are independent variables and predictors to SAT in HERP since problems experienced by HERP users are always surrounded among these variables as stipulated in the ISSM. In a nutshell, four hypotheses to be investigated and the development of hypotheses is discussed in the following subheading.

4.3.1 The relationship between system quality and user satisfaction

SQ refers to measures of HERP on the quality of HERP performance from a technical viewpoint (D&M, 1992; Gable *et al*., 2008; Hsu *et al.*, 2015; Nelson *et al*., 2005). Several studies have shown that SQ influences SAT, for example Wang and Lai (2014) surveyed over 295 employee users and discovered that SQ positively influenced their SAT and supported by Makokha and Ochieng (2014). Conversely, Sun and Mouakket (2015) found that SQ did not influence SAT among 645 respondents and confirmed by Chi (2013). Additionally, Chakraborty and Sengupta (2014) in their research disputed that SQ does have a positive effect on SAT. Therefore, the researcher hypothesises:

Hypothesis 1 (H1): There is a significant relationship between system quality and user satisfaction.

4.3.2 The relationship between service quality and user satisfaction

According to Nikhashemi *et al*. (2013), SVQ plays a major role in determining SAT. Several studies had investigated the influence of the SVQ construct on the SAT, for example Makokha and Ochieng (2014) indicated that SVQ positively affects SAT. Additionally, Wang and Lai (2014) also affirmed that the SAT is positively influenced by SVQ. However, Lwoga (2013) argued that SAT is not influenced by SVQ after distributing questionnaires to 368 undergraduate students. Based on this reasoning, the researcher hypothesises:

Hypothesis 2 (H2): There is a significant relationship between service quality and user satisfaction.

4.3.3 The relationship between information quality and user satisfaction

Wang and Lai (2014) determined that one of the essential factors that influence SAT is IQ. Additionally, various researchers have conducted studies on the relationship between IQ and SAT, for example Wang and Lai (2014) acknowledged that IQ has a positive effect on SAT in their quantitative study which questioned 295 employees and the findings supported by Cho *et al*. (2015). Nonetheless, Ghobakhloo and Tang (2015) in a survey of 400 business executives, debated the opposite that IQ does not predict SAT. Therefore, the researcher hypothesises:

Hypothesis 3 (H3): There is a significant relationship between information quality and user satisfaction.

4.3.4 The relationship between user satisfaction and individual benefits

Evidence in the IS literature indicates that satisfied HERP users are more likely to be productive exceptionally where the use of such HERP is mandatory (Hsu *et al*., 2015). Therefore, the researcher hypothesises:

Hypothesis 4 (H4): There is a significant relationship between user satisfaction and individual benefits.

4.4 Research design

The research design describes obviously the few steps to be carried out through a research program to reach the research objectives (Creswell, 2009; Sahu, 2013). Essentially, three research approaches to discover the findings to the research questions, namely quantitative, qualitative and mixed method research (Creswell, 2009). According to Sahu (2013), a quantitative research is a systematic investigation having quantitative property and allow the researcher to quantify occurrences and analyse statistically. Furthermore, two selections are presented related to the time horizons namely longitudinal and cross-sectional study. Whereas, the longitudinal study is preferable to pursue how things change over a period of time that involves data from the particular sample units at several time frames (Beins & McCharty, 2012; Sahu, 2013). Whereas, in a cross-sectional study that the data for both independent and dependent variables are gathered at the specific point of time (Bhattacherjee, 2012). In the present study, the cross-sectional and quantitative survey was used for the research objectives to test the association among the proposed constructs for HERP post-implementation success in the context of the healthcare industry.

4.4.1 Questionnaire design

According to Slattery, Voelker, Nussenbaum, Rich, Paniello and Neely (2011) that surveys or questionnaires are compelling research instruments for producing significant data throughout suitable development, deployment and management of research instruments. Questionnaire refers to a particular self-administered instrument for collecting information through a series of questions. Subsequently, the set of the study questionnaire had been reviewed by two experienced academicians in IS field and two experts of HERP in the healthcare industry as a part of content validity.

Furthermore, the review is to ensure the universe of content items are valid and avoid misinterpretation among respondents (Lietz, 2010; Slattery *et al*., 2011). The pre-test is a preliminary assessment of the measurement instrument to recognise any possible difficulties that may encounter among respondents when filling out questionnaires (Bhattacherjee, 2012). Thus, before the final draft of the questionnaire is released, ten respondents are selected randomly to answer the draft of survey questionnaires. Subsequently, the respondents commented that questionnaires in the English language are understandable. All of their comments and suggestions regarding the clarity, wording and consistencies of the questions are considered to be encompassed into the final draft of the survey questionnaire. Therefore, the design of questionnaire for this study is divided into three parts as follows:

1. Part I is to measure HERP user's perception of the elements of SQ, SVQ, IQ, SAT and IBS of CordLife Group's HERP.
2. Part II is for the respondent to indicate any comments or suggestions for the betterment of CordLife Group's HERP.

3. Part III is to collect respondent's demographic information that includes subsidiary country, gender, department, age, education, position level, HERP usage experience, a closed question confirming respondent as CordLife Group's HERP user.

The respondent's demographic questions are positioned at the last section of the questionnaire to mitigate the negative feeling from the respondents (Lietz, 2010).

4.5 Operationalisation and measurement of variables

The operational described as the interpretation process for translating an abstraction of the theoretical construct into a concept and should be measured throughout several tangible indicators (Beins & McCharty, 2012). Furthermore, an operational meaning of a particular variable explains how it is described and measured within the study's research framework (Sahu, 2013). Therefore, the measurement scales are needed to be identified in the questionnaire development stage. Additionally, the questionnaire scales in this study have adopted from Hsu *et al*. (2015) study that had been validated to be reliable. The total number of items used is forty-one (41) items. The questionnaire consists of eleven (11) measurement scales that includes:

1. 2 scales represented by System-Related and Task-Related to form System Quality.
2. 2 scales represented by Content and Representation to form Information Quality.
3. 5 scales represented by Tangibility, Reliability, Responsiveness, Assurance and Empathy to form Service Quality.
4. Multiple-item scale is used to measure User Satisfaction.
5. Multiple-item scale is used to measure Individual Benefits.

The sources for original measurement scales and reliability results are summarised and shown in Appendix B. The five-point Likert scale varying from 1 = "strongly disagree" to 5 = "strongly agree" is applied in the present study for every item of SQ, SVQ, IQ, SAT and IBS. For instance, in Section A, the respondents were requested to circle at the number of their choice that best reflects on their perception using a five-point Likert scale towards SQ on system-related: "The HERP is easy to use". The target respondents were HERP users who have adopted CordLife Group's HERP and understand the questionnaire in the English language. Moving forward, the operational definition and measurement of each construct and variable applied in this study are clarified in the following subheading.

4.5.1 Service quality as second-order construct

The researcher adopted prior SVQ measures from Hsu *et al.* (2015), Parasuraman *et al*. (1988) and Pitt *et al.* (1995) to characterise the experience of the IS support service that HERP users gather from the in-house IS staff. According to the previous studies, the 20-item scale is applied to apprehend the five dimensions of SVQ: Tangibility, Reliability, Responsiveness, Assurance and Empathy. The researchers advise that SVQ should be a formative and higher-order construct (Parasuraman *et al*., 2005) since the dimensions produce the overall perception of SVQ. Consequently, the researcher models SVQ as second-order formative construct formed by the five first-order dimensions. Conversely, the first-order dimensions are operationalised as reflective constructs. The operational definition and measurement scale for SVQ dimensions are stated in the subsequent subheading.

4.5.2 Tangibility dimension

Tangibility denotes physical facilities, equipment and appearance of personnel (Hsu *et al.,* 2015; Parasuraman *et al*., 1988; Pitt *et al.*, 1995). The tangibility dimension is measured reflectively by the 4-item scale which is adapted and modified from Parasuraman *et al*. for the perceived scale of SERVQUAL. Therefore, components contained in the tangibility dimension is equipment, physical facilities, staff and appearance. The reliability result from Parasuraman *et al*. study for this dimension is 0.72. The items to measure tangibility dimension are presented in Table 4.1.

Table 4.1
Measurement scale of tangibility dimension

Index	Item	Source
TAN1	The IS department has up-to-date hardware and software.	Hsu *et al*. (2015)
TAN2	The physical facilities in the IS department are visually appealing.	Pitt *et al*. (1995)
TAN3	The staff in the IS department is well dressed and neat in appearance.	Parasuraman *et al*. (1988)
TAN4	The appearance of the physical facilities of the IS department is in keeping with the type of services provided.	

4.5.3 Reliability dimension

Reliability has defined an ability to perform the promised service dependably (Hsu *et al.,* 2015; Parasuraman *et al*., 1988; Pitt *et al.*, 1995). Hence, the components of reliability dimension were represented by promises, problem solving, dependable, time and accuracy. The reliability dimension is measured reflectively by the 5-item scale which is adapted and modified from Parasuraman *et al*. SERVQUAL scale. Subsequently, the reliability result from Parasuraman *et al*. study for this dimension is 0.83. The items to measure reliability dimension are presented in Table 4.2.

Table 4.2
Measurement scale of reliability dimension

Index	Item	Source
REL1	When the IS department promises to do something by a certain time, it will do so.	Hsu *et al*. (2015) Pitt *et al*. (1995) Parasuraman *et al*. (1988)
REL2	When users have a problem, the IS department shows a sincere interest in solving it.	
REL3	The IS department is dependable.	
REL4	The IS department provides its services at the times it promises.	
REL5	The IS department insists on error-free records.	

4.5.4 Responsiveness dimension

Responsiveness refers to the willingness to support with swift service (Hsu *et al.*, 2015; Parasuraman *et al*., 1988; Pitt *et al.*, 1995). Thus, the responsiveness dimension in this study is measured reflectively by the 3-item scale which is adapted and modified from the perceived scale of SERVQUAL. Additionally, the components of responsiveness dimension were integrated with information, promptness and attitude. Therefore, the reliability result from Parasuraman *et al*. study for this dimension is 0.82. The items to measure the responsiveness dimension are presented in Table 4.3.

Table 4.3
Measurement scale of responsiveness dimension

Index	Item	Source
RES1	The IS department tells users exactly when services will be performed.	Hsu *et al*. (2015) Pitt *et al*. (1995) Parasuraman *et al*. (1988)
RES2	The staff in the IS department gives prompt service to users.	
RES3	The staff in the IS department is never too busy to respond to users' requests.	

4.5.5 Assurance dimension

Assurance is described as an understanding and courteousness of employees and their capability to instigate trust and confidence (Hsu *et al.*, 2015; Parasuraman *et al*., 1988; Pitt *et al.*, 1995). Consequently, the assurance dimension is measured reflectively by the 4-item scale that adapted and modified from the perceived scale of SERVQUAL.

The components of assurance dimension were explained by credibility, safety, attitude and readiness. The reliability result from Parasuraman *et al*. study for this dimension is 0.81. Essentially, the items to measure assurance dimension are presented in Table 4.4.

Table 4.4
Measurement scale of assurance dimension

Index	Item	Source
ASS1	The behaviour of the staff in the IS department instils confidence in users.	Hsu *et al*. (2015) Pitt *et al*. (1995) Parasuraman *et al*. (1988)
ASS2	I feel safe in my transactions with the IS department staff.	
ASS3	The staff in the IS department is consistently courteous with users.	
ASS4	The staff in the IS department has the knowledge to do its job well.	

4.5.6 Empathy dimension

Empathy refers to affection and personalised attention provided by in-house IS staff (Hsu *et al*., 2015; Parasuraman *et al*., 1988; Pitt *et al.*, 1995). Therefore, the empathy dimension is measured reflectively by the 4-item scale which is adapted and modified from the perceived scale of SERVQUAL.

Table 4.5
Measurement scale of empathy dimension

Index	Item	Source
EMP1	The IS department has operating hours that are convenient to all users.	Hsu *et al*. (2015) Pitt *et al*. (1995) Parasuraman *et al*. (1988)
EMP2	The IS department give users personal attention.	
EMP3	The IS department has the users' best interests at heart.	
EMP4	The staff of the IS department understands the specific needs of users.	

Additionally, the components consisted in empathy dimension were attentive, fulfilment of needs, interest and convenience. Hence, the reliability result from Parasuraman *et al*. study for this dimension is 0.86. The items to measure empathy dimension are presented in Table 4.5.

4.5.7 System quality as second-order construct

Another construct in the research framework, namely SQ is measured by the 9-item scale adopted from Gable *et al*. (2008), Hsu *et al.* (2015) and Nelson *et al*. (2005). According to Nelson *et al*. (2005), the dimensions of SQ applying a variety ranging from system to task. Therefore, the researcher classified the measuring items into system-related and task-related as reflective latent constructs. However, the SQ is conceptualised as a second-order formative construct in the present study. In subsequent subheading, operational definition and measurement scales for all dimensions under SQ construct are discussed.

4.5.8 System-related dimension

Generally, items for system-related dimension measured the quality of HERP that are consistent across various uses and independent of task, setting or application, for example ease of use, ease of learning and system accuracy. Additionally, system-related dimension is measured with the 4-item scale adopted from Gable *et al*. (2008), Hsu *et al.* (2015) and Nelson *et al*. (2005). Thus, the reliability for this dimension is 0.83. The items to measure system-related dimension are presented in Table 4.6.

Table 4.6
Measurement scale of system-related dimension

Index	Item	Source
SSR1	The HERP is easy to use.	Hsu *et al*. (2015)
SSR2	The HERP is easy to learn.	Gable *et al*. (2008)
SSR3	The HERP always processes data accurately.	Nelson *et al*. (2005)
SSR4	The HERP requires only a minimum number of fields and steps to achieve a task.	

4.5.9 Task-related dimension

Essentially, task-related dimension consisted of items measuring the characteristics of HERP that are assessed in the setting of a particular task, for example flexibility, integration, customisation and user requirements. Hence, task-related dimension is measured by the 4-item scale adopted from Gable *et al*. (2008), Hsu *et al.* (2015) and Nelson *et al*. (2005). Additionally, the reliability for the aforementioned dimension is 0.85. The items to measure task-related dimension are depicted in Table 4.7.

Table 4.7
Measurement scale of task-related dimension

Index	Item	Source
STR1	The HERP meets my requirements.	Hsu *et al*. (2015)
STR2	The HERP includes necessary features and functions for my job.	Gable *et al*. (2008)
STR3	The HERP user interface can be easily adapted to my personal approach.	Nelson *et al*. (2005)
STR4	The HERP can be easily modified or improved according to my needs.	

4.5.10 Information quality as second-order construct

The researcher measured IQ through the 5-item scale adopted from Gable *et al*. (2008), Hsu *et al.* (2015) and Nelson *et al*. (2005). Thus, capturing two IQ dimensions like context and representation as reflective latent constructs (Nelson *et al*., 2005). Consequently, IQ as a second-order formative construct comprising the two dimensions given that alterations in the context and representation dimension of the system output will affect users' perception of IQ. The operational definition and its measurement scales for IQ are discussed in the following subheading.

4.5.11 Context dimension

Items for context dimension assessed the level to which the HERP is useful in functioning specific tasks, for example relevance and availability. Context dimension is measured by the 3-item scale adopted from Gable *et al*. (2008), Hsu *et al.* (2015) and Nelson *et al*. (2005). Thus, the reliability for this dimension is 0.85. The items to measure the context dimension are presented in Table 4.8.

Table 4.8
Measurement scale of context dimension

Index	Item	Source
ICT1	The HERP provides output that seems to be exactly what I need.	Hsu *et al*. (2015)
ICT2	Information needed from the HERP is always available.	Gable *et al*. (2008)
ICT3	Information from the HERP is in a form that is readily usable.	Nelson *et al*. (2005)

4.5.12 Representation dimension

The items for representation dimension evaluated the level to which HERP information demonstration effectively enables clarifications and comprehending, for example format and conciseness. Thus, representation dimension is measured by the 2-item scale adopted from Gable *et al*. (2008), Hsu *et al.* (2015) and Nelson *et al*. (2005). Additionally, the reliability for this dimension is 0.91. Essentially, the items to measure the representation dimension are presented in Table 4.9.

Table 4.9
Measurement scale of representation dimension

Index	Item	Source
IRP1	Information from the HERP appears readable, clear and well formatted.	Hsu *et al*. (2015) Gable *et al*. (2008)
IRP2	Information from HERP is concise.	Nelson *et al*. (2005)

4.5.13 User satisfaction

SAT with the HERP is measured by the 4-item scale (Hsu *et al.*, 2015; Sedera & Tan, 2005; Wixom & Todd, 2005). Additionally, the SAT is conceptualised as a formative

construct since total satisfaction with the HERP is a mixture of several measures. Whereas, each measure takes different characteristics of satisfaction in the occasion (Petter *et al*., 2007). Therefore, the grouping of these measures defines an individual SAT with the HERP. The reliability results were significant weight at range 0.17 to 0.44. The items for operationalising SAT are presented in Table 4.10.

Table 4.10
Measurement scale of user satisfaction

Index	Item	Source
SAT1	I am satisfied with the system quality.	Hsu *et al*. (2015)
SAT2	I am satisfied with the information quality.	Wixom and Todd (2005)
SAT3	I am satisfied with the service quality.	Sedera and Tan (2005)
SAT4	I am satisfied with the overall HERP system.	

4.5.14 Individual benefits

Last but not least, IBS construct with the 4-item scale established by Tansley *et al*. (2001), Alshibly (2011) and Hsu *et al.* (2015) is adopted in the present study.

Table 4.11
Measurement scale of individual benefits

Index	Item	Source
IBS1	The HERP improve my learning needs.	Hsu *et al*. (2015)
IBS2	The HERP improve my job performance.	Alshibly (2011)
IBS3	The HERP enhances my effectiveness in the job.	Tansley *et al.* (2001)
IBS4	The HERP increases my job productivity.	

IBS refers to the level to which the HERP has influenced the users' capabilities and effectiveness on behalf of the organisation. Particularly, the respondents have examined whether HERP influenced their learning, awareness / access of job-related information, decision effectiveness and individual productivity. Hence, the researcher perceived IBS as a reflective construct. The reliability for this dimension is 0.95. The items to measure IBS are presented in Table 4.11.

4.5.15 Demographic data

The respondents were requested to specify which CordLife subsidiary country they are based in CordLife Group and to confirm that they are HERP users. There are seven demographic variables that include gender, department, age, highest educational qualification, the position of the respondents, confirmation as HERP registered users and the HERP usage experience. The demographic variables are measured by applying the categorical scale. The questions related to demographic variables are positioned at the end of the questionnaire to avoid negative sensitivity as it concerns providing personal information (Lietz, 2010).

Gender is asked on a dichotomous scale of male and female. Hence, the department is required for data analysis. The respondent is required to indicate their age range by choosing one of five categories. In the next scale, five categories of educational qualification are developed to measure the highest level of education. A dichotomous scale is used to measure the employment position level: (a)Non-executive; (b)Executive; (c)Managerial; and (d)Director/CEO/Top Management. Furthermore, a question to confirm the status is provided to validate the respondent as CordLife Group's HERP user and provision of the specific name of HERP as criteria for verification. Last but not least, five categories were used to measure the respondent's usage experience of HERP.

4.6 Data collection

Quantitative research depends on the accuracy, consistency and efficiency of the data as explained by Sahu (2013). Therefore, this subheading section consists of a

description about population, sampling frame, sampling size, unit of analysis, sampling technique and data collection procedure that gives a general view of how data was collected in the present study.

4.6.1 Population

According to Greener (2008), a population is identified as the overall universe of people or objects from which the sample is chosen. Conversely, Sahu (2013) argued population is a collection of well-defined objects. In this study, the population has been comprised of employees who adopt CordLife Group's HERP namely HERP registered users.

The researcher chooses CordLife Group for a number of reasons. Firstly, multiple HERP had implemented for CGL-Singapore and other subsidiary countries, such as Malaysia, Indonesia, Hong Kong, the Philippines and India. Thus, past implemented HERP indicated that the majority of employees have engaged upon HERP post-implementation success. On the other hand, HERP users are from various departmental users, for example management, sales, marketing, customer management, finance, fulfilment and laboratory. In this view, many of the employees had experience and knowledge to use the implemented HERP. Secondly, there are two subsidiary companies are publicly listed company, namely CGL-Singapore (SGX) and SLB-Malaysia (MYX). Thirdly, the fact the employees or HERP users had operated HERP since CGL-Singapore establishment in 2001. Moreover, the sampling frame of employees as HERP users are readily available. As a result of the argument above, the researcher selected and distributed questionnaires to CordLife Group' respondents.

4.6.2 Sampling frame

Sampling is the procedure whereby some components of the population are selected to represent the whole population (Blumberg, Cooper & Schindler, 2008). Hence, an ideal sampling frame should be acquired the complete list that all respondents within the target population wherein the exact number and respondents' details of HERP users.

Table 4.12
HERP users' population for CGL-Singapore

Country	S/N	Department	Number of HERP users	Population Ratio (%)
Singapore	a	Management	25	11.47%
	b	Sales	85	38.99%
	c	Marketing	20	9.17%
	d	Customer Management	21	9.63%
	e	Finance	22	10.09%
	f	Fulfilment	20	9.17%
	g	Laboratory	25	11.47%
			218	100.00%

Source: CordLife Group's Human Resource Department (2017)

Table 4.13
HERP users' population for SLB-Malaysia

Country	S/N	Department	Number of HERP users	Population Ratio (%)
Malaysia	a	Management	20	9.17%
	b	Sales	95	43.58%
	c	Marketing	15	6.88%
	d	Customer Management	14	6.42%
	e	Finance	18	8.26%
	f	Fulfilment	23	10.55%
	g	Laboratory	25	11.47%
			210	100.00%

Source: CordLife Group's Human Resource Department (2017)

Subsequently, aforementioned HERP users' details are acquired after requisition letter with University Utara Malaysia letterhead has been emailed and posted to CGL-Singapore and SLB-Malaysia. Therefore, letter to CordLife Group for requesting data of a total number of HERP users is attached in Appendix D. Consequently, the targeted

respondents comprised HERP users from CGL-Singapore and SLB-Malaysia as shown in Table 4.12 and Table 4.13, respectively.

4.6.3 Sampling size

According to Sahu (2013), it is a critical requirement for the researcher to determine whether the sample size is sufficient to provide adequate accuracy to base decisions with confidence. Thus, sufficient level of sample size reduced the margin of error (Saunders, Lewis & Thornhill, 2009); able to achieve the anticipate statistical effect (Tabachnick & Fidell, 2013). The shape of the distribution normality and variability might be standardised (Beins & McCarthy, 2012) and adequate to the generalisation of population interest (Sahu, 2013). Therefore, several methods to determine optimal sample size like Tabachnick and Fidell (2013) had recommended a sample size of at least 300 samples or more might generally produce a stable result in factor analysis. While, a study by MacCallum, Widaman, Zhang and Hong (1999) advised 200 to 400 samples able to achieve suitable recovery of population factors. Furthermore, high efficiency in parameter assessment and relationship significant can be gained from greater statistical power (Hair, Hult, Ringle & Sarstedt, 2014a).

In shaping a sample size of this study, the power of a test approach is one of feasible choice. Throughout the G*Power 3.1.9.2 software, sample size might be calculated after user determined value for an effect size of population ($f2$), expected significance level (α), intended statistical power ($1-\beta$) and a total number of predictors reside in the present study model (Faul, Erdfelder, Lang & Buchner, 2007). According to this study's research framework, the total number of the predictor is nine variables (see

Figure 4.2) were used for calculating the sample size. The standard values as recommended by Cohen (1977) applied to compute the sample size of the present study is (1) effect size of the population (*f*2= 0.15); (2) level of significance alpha (α= 0.05); (3) expected power of statistical (1-β = 0.80); and (4) total number of nine predictors.

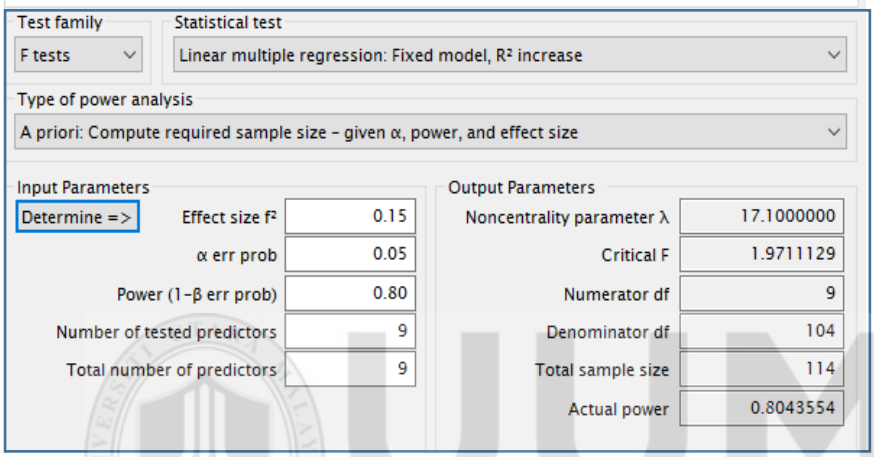

Figure 4.2
Result of sample size for medium effect

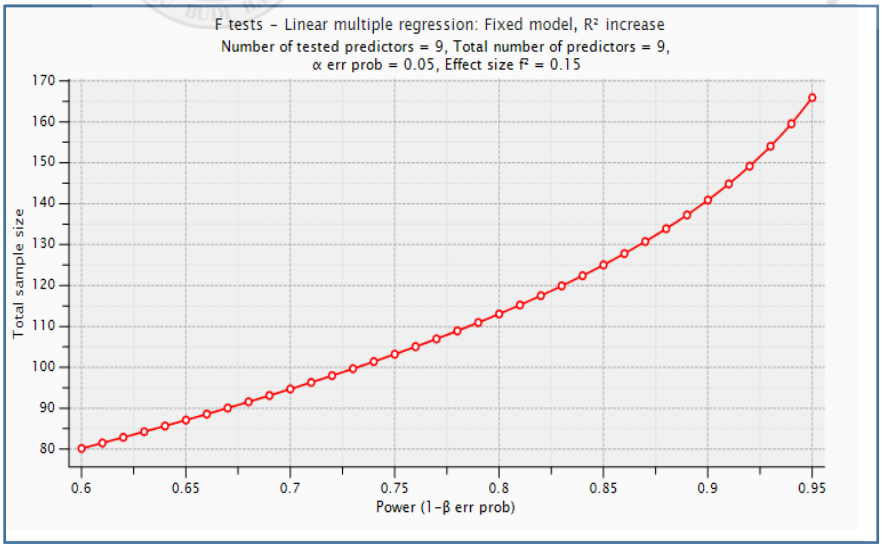

Figure 4.3
X-Y Plot for medium effect power

The result of sample size for medium effect and X-Y Plot for medium effect power analysis through G*Power 3.1.9.2 computation software is shown in Figure 4.2 and Figure 4.3, separately. Thus, as shown in Figure 4.2, 166 sample sizes are adequate for this study via a multiple regression. The results also indicate the statistical power for finding effect sizes for this study is set at a suggested value of 0.80 (Cohen, 1977). Therefore, it is decided that the entire sample size of the present study is 166 samples.

4.6.4 Unit of analysis

Referring to Neuman (1997) that unit of analysis described as what to be examined for assessment of variables. In addition, the unit of analysis might be in the form of individual, group or organisation (McDougall & Oviatt, 2000), varying on the setting and context of the study. Therefore, the unit of analysis for the present study is at the individual user level, whereby the CordLife Group's HERP users are identified as the respondents to answer the questionnaires. For that reason, all variables have been considered at the individual user level.

4.6.5 Sampling technique

As a rule, the sampling method is classified into two types that are probability and non-probability sampling. In this study, probability sampling method is selected as the findings can be generalised to the targeted population with a degree of confidence (Sekaran & Bugie, 2010). Stratification is a probability sampling technique that ensures there is a homogeneous source per strata but with heterogeneity between strata. Thus, the objects drawn from per strata might either proportionate or not to the quantity of components available in the strata. While, choice in disproportionate

sampling is selected upon either the particular strata are too small or too large (Sekaran, 2000). The multi-stage sampling procedure under the probability sampling (Bhattacherjee, 2012; Sahu, 2013) is applied in the present study to reach the maximum representative of the population in CordLife Group. Therefore, the multi-stage procedure involves stratified sampling, cluster sampling and simple random sampling for this study.

Firstly, cluster sampling method used to choose CGL-Singapore and SLB-Malaysia. Secondly, the stratified sampling method is used where the sample of HERP users is stratified by each department. Last but not least, the simple random sampling technique is applied to assure equal chance participation from HERP users' population. The aforementioned stratified sample list of the number HERP users are obtained from CordLife Group human resource department. Therefore, the simple random sampling technique is applied to select HERP users by the department in the chosen subsidiaries. This study aims at least 166 questionnaires to be answered and replied to the researcher from each CGL-Singapore and SL-Malaysia, respectively. Concisely, the minimum in total 80% success respondents with all usable answered questionnaires to ensure the collected sample is fairly represented, unbiased and normality. Based on the sample size as discussed in preceding subheading, the total HERP users' population of the selected clusters was 428 and the total required sample size was 166 samples from each country. In order to reduce sample size error and minimise non-response issue, the sample size was increased to 100% based on 85% of response rate estimation and rounded to 180. Therefore, in total of 428 questionnaires were distributed.

4.6.6 Data collection procedure

As this study used primary data, thus, a self-administered technique through cross-sectional study design and multi-stage sampling approach is utilised for selecting the HERP users. Whereas, the cross-sectional study contains data collection for a particular study that managed at a specific point in time to meet the aims of the study (Cavana, Delahaye & Sekaran, 2001). The permission from CordLife Group's management was sought before the questionnaires to be distributed throughout email on the platform of online Google survey form. However, the printed hardcopy of the questionnaires was distributed to any HERP users who have difficulties accessing to the online questionnaires at Google Form application.

Accordingly, the University's official letter refers to the present research study as shown in Appendix D. After consent was granted from CGL-Singapore and SLB-Malaysia's management, study questionnaires were distributed to each chosen HERP users throughout email internal circular memorandum or by hand; respectfully request them to participate in study survey. In the event of respondents unable to complete the questionnaire immediately, the researcher will recollect the completed questionnaires while they are available. The data collection activities were conducted after obtaining approval from the dissertation defence committee.

4.7 Techniques of data analysis

Techniques of data analysis applied in the present study are combinations of descriptive and inferential statistics. Singh (2007) affirms descriptive statistics used to explain or summarise a certain set of data. Whereas, inferential statistics used to infer

the population from the samples collected. Generally, data analysis generates the statistical results in tables or figures that facilitate the researcher to conclude the research questions, hypotheses and the significance of the results (Creswell, 2012; Sekaran, 2003). Sekaran (2000) states data analysis involves several stages, for example coding the responses, screening the data and most importantly choosing the suitable data analysis approach. Hence, descriptive statistics were computed through Statistical Package Social Science (SPSS) version 22.0. In contrast, the reliability, validity and hypotheses testing were analysed using the SmartPLS version 3.0 throughout partial least squares-structural equation modelling (PLS-SEM) technique.

4.7.1 Data coding

Essentially, data coding described as the procedure converting data into a numeric format (Bhattacherjee, 2012). Coding exercise on the data is required after collecting the data from respondents as to keep data analytically (Zikmund, 2003) then enable statistical software to formulate additional variables (Saunders *et al*., 2009).

4.7.2 Data screening

Essentially, data screening is needed, particularly after the data have coded and input into the SPSS software to assure the evaluation outcome is clean from bad data characteristics, for example missing value, outliers and violation of assumptions (Hair, Black, Babin & Anderson, 2014b). Concisely, data screening vital to the process, however, it engages several processes as shown in the subsequent subheadings.

4.7.2.1 Missing data

Missing data are an incomplete or not available information, for example a respondent failed to answer any questions within a questionnaire (Hair *et al*., 2014b). However, there are several treatments for missing data (Hair *et al*., 2014a; Singh, 2007). For instance, Singh (2007) indicates numerous actions to tackle missing data like complete case analysis (list-wise deletion), available case methods (pairwise deletion) and filling in the missing values with projected scores (imputation). Whereas, Hair *et al*. (2014a) insist that in the event of the missing value to a particular survey is greater than fifteen percent (15%), thus all answers to that survey should be eliminated.

4.7.2.2 Assessment of outliers

Hair *et al*. (2014a) point out outlier is an excessive answer to a particular question or entire questions. Whereas, Beins and McCarthy (2012) identify outlier as a value that is extremely distinct from the bigger data set. Generally, outlier occurs due to incorrect data entry; interpretations within the population are excessive as a mixture of values of variables (Hair *et al*., 2006). Whereas, multivariate detection applied a Mahalanobis (D^2) measurement to measure interpretation's distance in multi-dimensional space from the mean centre of all interpretations; keeping a single value for each interpretation. Thus, Chi-square distribution is applied with an alpha level of 0.001 before compared to Chi-square (X^2) value. If Mahalanobis (D^2) > Chi-square (X^2) thus considered as an outlier (Hair *et al*., 2006). Furthermore, researchers cautioned to respond trend, for example straight lining as a respondent marks the identical answer for most of the questions (Hair *et al*., 2014a). This is interpreted that

the respondent is marking answers to complete the survey as quickly as possible and considered as outliers.

4.7.2.3 Assessment of normality

Generally, the normality of data distribution not a compulsory for PLS-SEM approach. Nonetheless, a stronger assessment can be done in case the distribution of data is not tremendously apart from normality baseline. Hence, Hair *et al*. (2014a) admit that excessive non-normal data might amplify standard error value yet reduce the probability of significant relationships. Concisely, Hair, Black, Babin and Anderson (2010) claim that all statistical test results are invalid if data are not normally distributed or the variation of the data is extremely large.

Correspondingly, statistical results like skewness and kurtosis are used to detect extreme normality issue. Whereas, skewness calculates the distribution of responses for a variable that stretches toward the right or left tail of the distribution; Kurtosis measures “peakedness” or “flatness” of data compared to the normal distribution (Hair, Black, Barry & Anderson, 2010). Furthermore, the outcome of skewness and kurtosis should be near to zero to be deliberated as a normal distribution. Hair *et al*. (2014a) advise the range of skewness is greater than + 1 or lower than -1 to signify a considerably skewed distribution. For kurtosis, if the range is greater than +1, the distribution is extremely peaked and if less than -1 demonstrates a distribution that is extremely flat. Thus, data transformation used when the variable is non-normality. Essentially, a transformation, for example by choosing the logarithm or the square root of variable produce a transformed variable that is more fitting to depicting the

relationship. Transformation is applicable to dependent and independent variables (Hair *et al*., 2006).

4.7.2.4 Multicollinearity

Multicollinearity is associated with the extremely correlation among independent variables when the result shows 0.90 and above (Pallant, 2011). Correspondingly, multicollinearity relates to statistical problems like β coefficient values are less trustworthy, limit the size of the R value and subsequently challenging to evaluate the importance of a predictor (Field, 2009). Furthermore, multicollinearity can be detected through SPSS software tolerance value and variance inflation factor (VIF) in collinearity diagnostic results. According to Pallant (2011), multicollinearity exists if a tolerance value is smaller than 0.10 and VIF value greater than 10.

4.7.3 Descriptive analysis

Essentially, the aim of the descriptive analysis is to translate the primary data into information for researchers (Zikmund, 2003). In addition, the descriptive statistics classified into two categories: frequency distributions and measures of central tendencies and dispersion (Cavana *et al*., 2001). Although, the frequency distributions are shown in the method of frequency and percentages for the nominal scale and ordinal scale of the respondents' demographic data. Whereas, the calculation of central tendencies and dispersion elaborates the characteristics of data in terms of minimum, maximum, means, standard deviations and variance for the interval scale of the measured variables.

4.7.4 Path model estimation

SmartPLS version 3.0 was applied in the present study to compute the path model estimation. Thus, the researcher analyses empirical data for the indicators, the construct scores, the path coefficients, indicator loadings, weights and the R^2 values. Thus, these score results are regarded as for the indicator variables in the measurement models and utilise all the variance to justify the endogenous constructs (Hair *et al*., 2014a). Furthermore, some parameter settings are required, such as a structural model weighting scheme, data metric, initial values to run the PLS-SEM algorithm, the stop criterion and the maximum number of iterations. The outcomes, such as outer weights, outer loadings, structural model path coefficients and R^2 values (Hair *et al*., 2014a).

The PLS path modelling method is a usually applied in the calculation of causal relationships; including latent constructs that are measured indirectly by numerous indicators (Tenenhaus *et al*., 2005). Additionally, a PLS path model's description is kept by two models; a measurement model linking manifest variable (MVs) to latent variable (LVs) and a structural model that related to endogenous LVs to exogenous LVs. Also, the measurement model is signified to as the outer model, whereas the structural model is signified to the inner model. The inner model explores the relationship among unobserved or latent variables wherein the outer one explains the relationship among a latent variable and manifest variable.

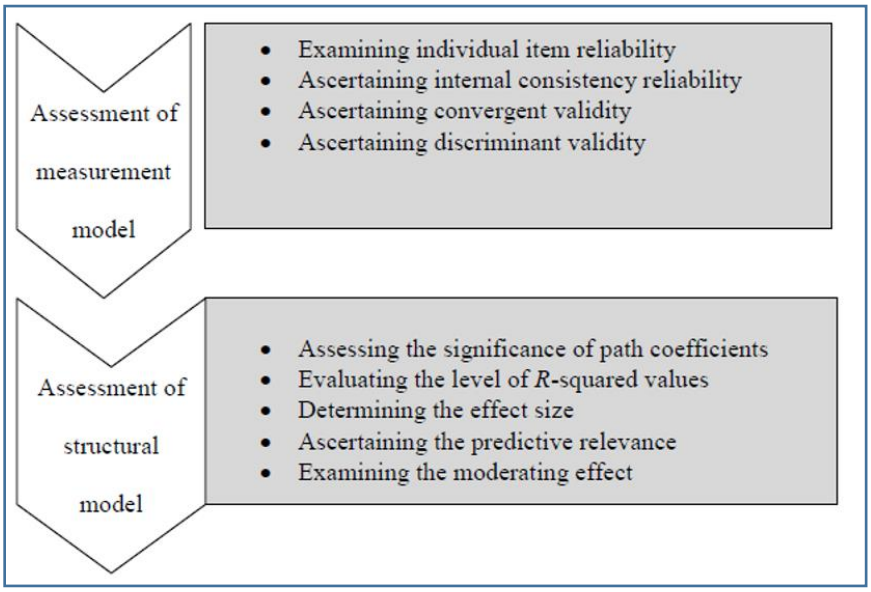

Figure 4.4
A two-step approach for reporting the results of PLS analyses
Source: Henseler *et al.* (2009)

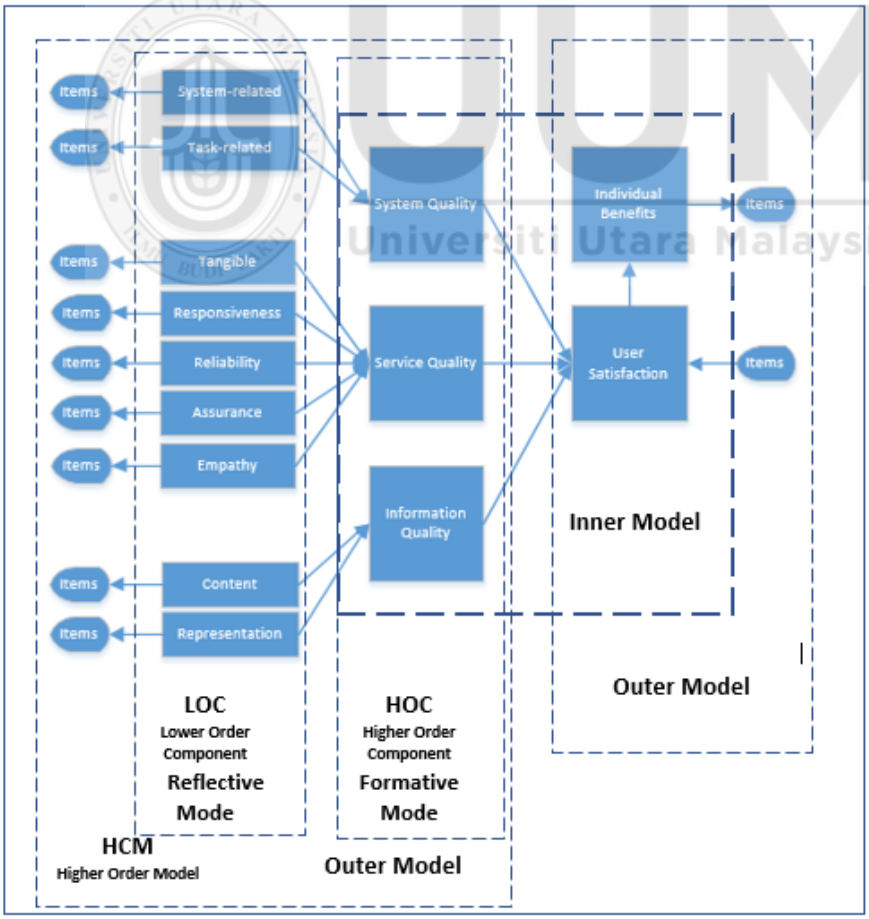

Figure 4.5
PLS Path Model

The two-step approach for reporting the outcomes of PLS analyses as summarised by Henseler *et al*. (2009) is graphically displayed in Figure 4.4. In addition, this study's PLS path model is depicted in Figure 4.5. Generally, PLS shows a recursive inner model that is exposed to the predictor specifications. Hence, the inner model encompasses a causal chain system and included two different types of outer models; the reflective and formative measurement models. The selection of a specific outer mode is enlightened by theoretical rationale (Diamantopoulos & Siguaw, 2006). The reflective mode develops a causal relation from the latent variable to the manifest variable. Therefore, every manifest variable in a particular measurement model is perceived as a linear function of the latent variable. Conversely, the formative mode develops a causal relation from a manifest variable to the latent variable. In a few words, it is vital to comprehend how "formative" and "reflective" are linked with the classification of "causal" and "effect", respectively.

4.7.5 Reflective and formative measurement of model

Generally, assessment of the measurement models for reflective approach includes composite reliability (CR), individual indicator reliability and average variance extracted (AVE). Thus, the composite reliability values interpreted alike Cronbach's alpha and acceptable values are 0.60 to 0.70; values between 0.70 and 0.90 regarded as satisfactory; the value above 0.90 are not desirable as it indicates that all the indicator variables are measuring the same phenomenon (Hair *et al*., 2014a). Beside content validity, discriminant validity and convergent reliability is another form of validity, which measures empirically by the correlation among variables (Hair *et al*., 2014b). Correspondingly, convergent validity assesses the correlation level within two

measures of the concept of interest. High correlations signify the scale is apprehended in the proposed concept.

The rule of thumb, the standardised outer loadings should be 0.70 or higher that commensurate to fifty percent (50%); below 0.7 should be removed (Hair *et al*., 2014a). However, to determine convergent validity is the average variance extracted (AVE), therefore AVE should within the range 0.50 or higher to signify the construct have been explained beyond half of the indicator's variance (Hair *et al*., 2014a). Additionally, discriminant validity defined as the level to which a construct is fairly different compared to other constructs by empirical standards. Nonetheless, the cross-loading outcome for every indicator was applied to calculate the discriminant validity and the value of outer loading on the specific construct should be higher than all loadings on other constructs (Hair *et al*., 2014a). In addition, the alternative assessment approach for discriminant validity, the Fornell-Larcker criterion is indicated by comparing the square root of the AVE values with the latent variable correlations. The square root of every construct's AVE should be greater than correlation loading in every construct (Hair *et al*., 2014a). This study theorises SQ, SVQ and IQ as second-order constructs through formative measurement approach. As a result, the tolerance and VIF standard to calculate collinearity is greater than 0.20 and lesser than 0.50.

Upon calculating the significance and relevance of the formative indicators, outer weight as developed from several regressions should be examined. In addition, the value of outer weight should be attained by using a bootstrapping technique at 5,000 subsamples. In addition, Hair *et al*. (2014a) suggest that in case the weight of

indicators is discovered not significant yet the outer loading is greater than 0.50, therefore the indicator should be kept. Otherwise, if both measurements are not significant and weak empirical support, in that case the indicator should be removed.

4.7.6 Hypothesis testing

Hypothesis testing is a statistic portraying a population (Mooi & Sarstedt, 2011). Concisely, the direct effect of four hypotheses (H1, H2, H3 and H4) as detailed in preceding heading. Given that two data set, namely CGL-Singapore and SLB-Malaysia, therefore the four hypotheses multiplied into two, for example, H1, with H1a and H1b, for testing CGL-Singapore and SLB-Malaysia, respectively (see Table 4.16).

4.7.6.1 Direct effect

Referring to Hair *et al*. (2014a), the direct effect is a single arrow connecting to the relationship between two constructs. Correspondingly, there are four direct effects have been tested in four hypotheses indexed as H1, H2, H3 and H4. Whereas, the PLS-SEM algorithm with bootstrapping procedure of 5,000 subsamples iteration to analyse relationships amongst the constructs. In addition, the strength of path coefficients is interpreted through how close path coefficient value to +1 that signified great positive or negative relationships. The standard error is produced by means of bootstrapping technique where it allows t-value to be computed. The critical values for two tailed tests as hypothesised in this study are 1.96 for the significance level of 5% and 2.57 for the significance level of 1%. The significance level of 5% is commonly referred to the marketing research (Hair *et al*., 2014a). This means that if the t-value is

more than 1.96, it supports the hypothesis path. In contrary, the hypothesis path is not supported and rejected if t-value is less than 1.96.

4.7.7 Justification using PLS-SEM technique

PLS-SEM technique is an iterative technique for amplifying the explained variance of endogenous constructs (Hair, Sarstedt, Hopkins & Kuppelwieser, 2014c). The PLS-SEM to examine the complicated model, for example a moderator, hierarchical component model, non-linear relationship and flexible to reflective or formative measurement (Sarstedt, Ringle, Smith, Reams & Hair, 2014b). Thus, the solicitation of PLS-SEM approach in this study is justified by the following explanations.

First and foremost, PLS-SEM is rising in public acceptance due to its application capability and capacity in handling non-normal data, particularly in social science studies. In addition, PLS-SEM capable to calculate an extremely complicated model, for example, numerous constructs, structural models, many indicators hierarchical relationship and formative measured constructs (Hair *et al*., 2014c; Sarstedt *et al*., 2014b). There are forty-one (41) indicators, application of reflective-formative measurement for three constructs and hierarchical relationship for three constructs are conceptualised in the present study.

Secondly, the relationship amongst a latent variable and its measures can be modelled in the form of formative or reflective using PLS-SEM versus CB-SEM like AMOS, which is normally limited to reflective measurement (Sarstedt, Ringle, Henseler & Hair, 2014a) and measurements of the formative outer model are appropriate within

particular circumstances (Hair, Sarstedt, Pieper & Ringle, 2012a). Additionally, Hair *et al*. (2014a) affirm PLS-SEM has the capability to apply formative measures in the research model framework that aim at clarifying and forecasting dependent constructs. In this manner, three latent constructs in this study like SQ, SVQ and IQ are as formative measures from its dimensions, separately.

Table 4.14
Rule of thumb for selecting Covariance-SEM and PLS-SEM

No.	Issue	Covariance-SEM	PLS-SEM
1	Research Goals	Theory testing, confirmation and comparison.	Predicting key target construct, explanatory research and extension of an existing structural theory.
2	Measurement Model Specification	Mostly reflective measures.	Both formative and reflective measures.
3	Structural Model Assumptions	Non-recursive Model Parametric with sample size and data distribution Assumptions.	Complex Model Non-parametric does not require assumptions to be fulfilled.
4	Sample Size	Large	Small and Large
5	Model Specification	If the research requires goodness-of-fit criterion.	If the research will use latent variable scores in subsequent analyses.

Source: Hair, Ringle and Sarstedt (2011)

Thirdly, Hair, Ringle and Sarstedt (2013) argue that hierarchical component models or higher-order models are comparatively comfortable to be analysed in PLS-SEM. Additionally, the PLS-SEM is efficient in examining numerous layers of constructs that including second-order constructs (Hair *et al*., 2014a). Hence, the characteristics of the research framework in this study comprised of three second-order constructs suggested that PLS-SEM is a suitable technique to be applied. Last but not least, SPSS is used to check the status of excessive abnormality among collected data yet PLS-SEM to further confirm there is no issue on data normality as correspondingly to statements made by Hair *et al*. (2014a) and Becker, Klein and Wetzels (2012). Subsequently, PLS-SEM does not essentially insist on data to be normal, hence the

benefit of PLS-SEM in the present study is suggested. In a nutshell, Table 4.14 shows the rule of thumb for choosing CB-SEM and PLS-SEM was outlined by Hair *et al.* (2011) to justify the application of PLS-SEM in this study.

4.8 Pilot study

Essentially, the pilot study aims to establish the reliability and validity of an instrument, for example improvement on questionnaire and scales, understandable, effectively operationalise towards study objectives (Bhattacherjee, 2012; Cohen *et al.*, 2007; Cresswell, 2009). Subsequently, this study had conducted a pilot study prior to the final questionnaire as shown in Appendix D. A pilot study was conducted using a convenience sampling technique to fifty (50) HERP users who have adopted HERP usage in CordLife Indonesia, CordLife Hong Kong and CordLife Philippines. These participants were excluded from the succeeding major study. The outcomes from the pilot study helped to improve questionnaire items, establish internal consistency reliability, face and content validity of the adopted and adapted questionnaire.

Table 4.15
Pilot study's results of Cronbach's Alpha

No.	Construct	S/N	Variable	Number of Indicators	Cronbach's Alpha α
1	System Quality (SQ)	a	System-related (SSR)	4	0.730
		b	Task-related (STR)	4	0.771
2	Information Quality (IQ)	a	Content (ICT)	3	0.832
		b	Representation (IRP)	2	0.828
3	Service Quality (SVQ)	a	Tangibility (TAN)	4	0.810
		b	Responsiveness (RES)	3	0.781
		c	Reliability (REL)	5	0.820
		d	Assurance (ASS)	4	0.790
		e	Empathy (EMP)	4	0.832
4	Individual Benefits (IBS)	a	Individual Benefits (IBS)	4	0.750
			Total items	**37**	

Subsequently, all collected data were analysed for the Cronbach's Alpha in order to check the internal reliability of consistency of the intended measurement and SPSS software was used for this purpose. For the scales guideline, the acceptable Cronbach Alpha value of explanatory research is 0.60 to 0.70 and for advanced research is amongst 0.70 and 0.90 (Hair *et al.,* 2014a). Further, they reminded that values above 0.90 demonstrate the indicators measure the same scenario and it is not desirable. The result of the pilot study was shown in Table 4.15. Additionally, the original measurement scales and reliability result adopted from the previous studies are tested with a high reliability and validity as shown in Appendix B. Therefore, this study is permitted to proceed the study questionnaire as shown in Appendix C and distributed to respondents after approval from proposal defence committee.

4.9 Chapter summary

The research methodology for the present study has been thoroughly discussed as it covers the proposed research framework and hypotheses. Whereas, the subsequent heading outlined the questionnaire design which concerned with the measurement of variables. Furthermore, this chapter also discussed the methods of data collection, such as the population, sampling frame, sample size, sampling technique and data collection procedure to rationalise for the research design. Thus, the more technical description under data analysis technique had discussed the method and type of data analysis techniques applied in this study include justifications adopting such technique. Last but not least, this chapter has identified the rationale of the pilot study for the present study. For better reference, the mapping between research questions, research

objectives, research outcome and hypotheses testing are summarised in Table 4.16. In a nutshell, the research methodology flowchart diagram is presented in Figure 4.6.

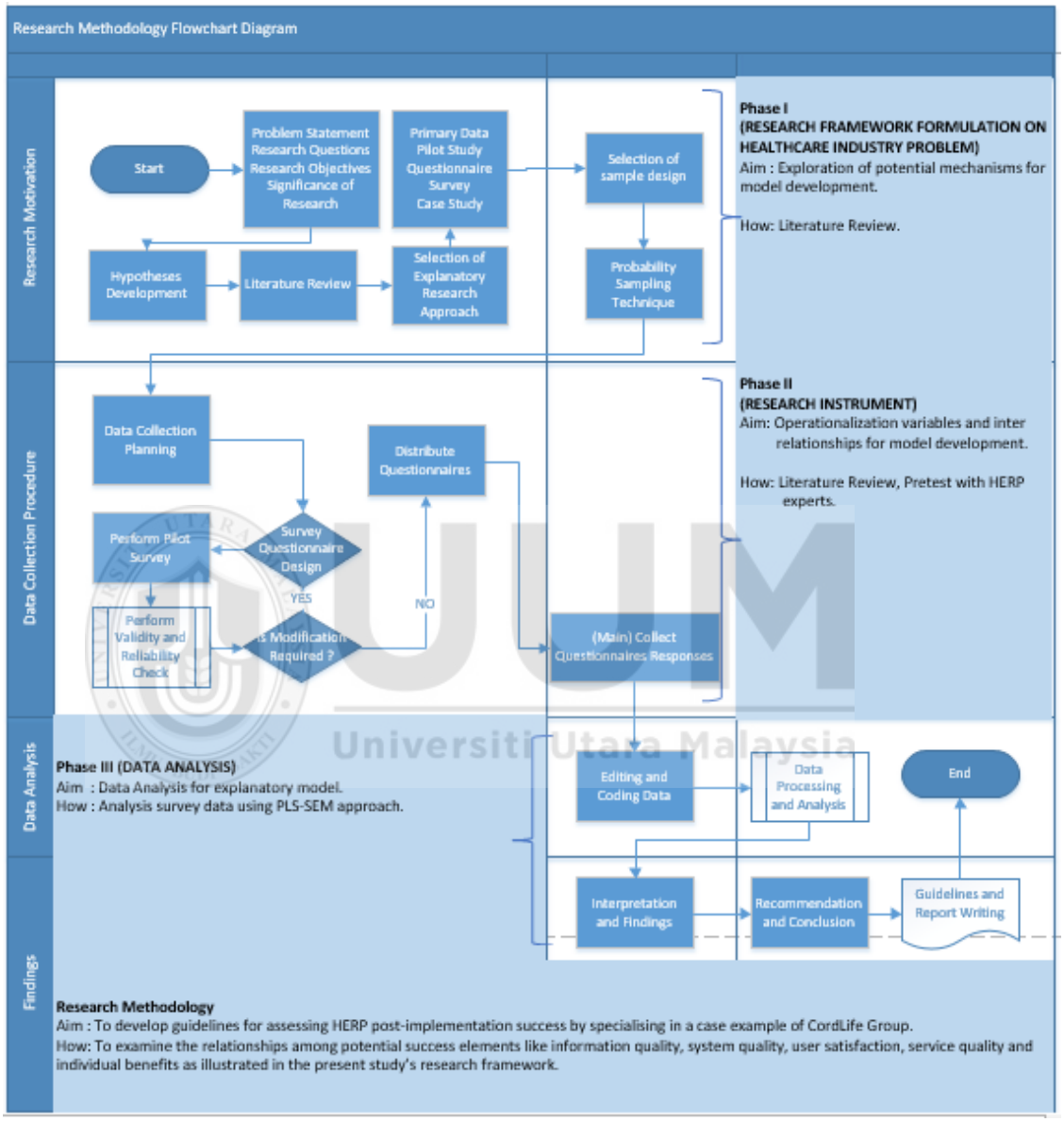

Figure 4.6
Research methodology flowchart diagram

Table 4.16

Summary of hypotheses testing

No.	Research Question	Research Objective	Research Outcome	Index	Hypotheses	Analysis Technique
1	What are the determinants that affect CordLife Group's HERP post-implementation success?	To identify the determinants that affect CordLife Group's HERP post-implementation success.	A Framework for assessing HERP post-implementation success.	H1a	There is a significant relationship between system quality and user satisfaction in CordLife Group Limited-Singapore.	PLS-SEM Regression
				H1b	There is a significant relationship between system quality and user satisfaction in StemLife Berhad-Malaysia.	PLS-SEM Regression
2	Can the success elements of the D&M ISSM be used as determinants that affect CordLife Group's HERP post-implementation success?	To integrate the D&M ISSM success elements as determinants for assessing CordLife Group's HERP post-implementation success.		H2a	There is a significant relationship between service quality and user satisfaction in CordLife Group Limited-Singapore.	PLS-SEM Regression
				H2b	There is a significant relationship between service quality and user satisfaction in StemLife Berhad-Malaysia.	PLS-SEM Regression
3	What are the differences between CordLife Group Limited-Singapore and StemLife Berhad-Malaysia on the determinants that affect CordLife Group's HERP post-implementation success? .	To identify the differences between CordLife Group Limited-Singapore and StemLife Berhad-Malaysia on the determinants that affect CordLife Group's HERP post-implementation success.		H3a	There is a significant relationship between information quality and user satisfaction CordLife Group Limited-Singapore.	PLS-SEM Regression
				H3b	There is a significant relationship between information quality and user satisfaction in StemLife Berhad-Malaysia.	PLS-SEM Regression
				H4a	There is a significant relationship between user satisfaction and individual benefits in CordLife Group Limited-Singapore.	PLS-SEM Regression
				H4b	There is a significant relationship between user satisfaction and individual benefits in StemLife Berhad-Malaysia.	PLS-SEM Regression

CHAPTER FIVE

ANALYSIS AND FINDINGS

5.1 Introduction

This chapter discusses in details about the results of the data analysis. First of all, the response rate is exhibited that from the field. Secondly, results from normality analysis and multicollinearity throughout SPSS approach for five dimensions of SVQ, two dimensions of IQ, two dimensions of SQ, SAT and IBS variable. At the next level up, the measurement model throughout construct validity and reliability analysis are examined by PLS-SEM method. In the subsequent heading, the relationships between SQ, SVQ, IQ, SAT and IBS constructs are analysed on the structural model level. Last but not least, the results for the hypotheses were presented and discussed.

5.2 Analysis of survey response

To all intents and purpose, this section presents the result of collection data, particularly on the demographic data analysis result. In addition, this section also emphasises the findings from the collected data, such as response rate, test for non-bias response and profile of respondents.

5.2.1 Response rate

Essentially, 428 questionnaires were disseminated to CGL-Singapore and SLB-Malaysia, based on the stratified sampling approach. After two weeks, a total of 395 questionnaires was gathered. However, only a total of 364 questionnaires has finally kept that equivalent to 85% response rate for the data analysis. From the collected data

breakdown, a total of 31 responses were discarded from the analysis because of two main reasons. Firstly, those respondents marked the identical response which meant as "straight line" added to a total of 26 questionnaires. Secondly, a total of 5 questionnaires were dropped since the respondents are not the HERP's user. The departments and the descriptive result of the collected questionnaires were depicted in Table 5.1 and Table 5.2, for CGL-Singapore and SLB-Malaysia, respectively.

Table 5.1
Departments and the descriptive result of the collected questionnaires for CGL-Singapore

Country	S/N	Department	HERP users	Returned	Rejected	Usable
Singapore	a	Management	25	21	3	18
	b	Sales	85	81	4	77
	c	Marketing	20	18	1	17
	d	Customer Management	21	19	0	19
	e	Finance	22	18	2	16
	f	Fulfillment	20	17	1	16
	g	Laboratory	25	23	2	21
		Total of Frequency	**218**	**197**	**13**	**184**
		Rate Percentage	**100%**	**90%**	**6%**	**84%**

Table 5.2
Departments and the descriptive result of collected questionnaires for SLB-Malaysia

Country	S/N	Department	HERP users	Returned	Rejected	Usable
Malaysia	a	Management	20	18	0	18
	b	Sales	95	89	2	87
	c	Marketing	15	14	4	10
	d	Customer Management	14	13	4	9
	e	Finance	18	18	3	15
	f	Fulfillment	23	22	2	20
	g	Laboratory	25	24	3	21
		Total of Frequency	**210**	**198**	**18**	**180**
		Rate Percentage	**100%**	**94%**	**9%**	**86%**

The usable questionnaires for this study were marginally higher than the preferred sample size of 166 as suggested by G Power technique. In addition, the variance of samples comprises a wide range of the HERP users' characteristics throughout different departments in CordLife Group. As fulfilling the statistical requirement, 184 CGL-

Singapore and 180 SLB-Malaysia usable questionnaires are more than necessary sample size based on the rule of thumb commensurate to ten times of the number of independent variables in the present study (Hair *et al.,* 2014a). In accordance, 110 sample sizes are adequate for analysis as the present study comprises of 11 independent variables. Meanwhile, the present study for analysis methodology requires a minimal range of 30 to 100 responses only as required by PLS-SEM application (Chin & Newsted, 1999). In conclusion, a total of 184 and 180 respondents each of this study is significantly sufficient for analysis.

5.2.2 Test for non-response bias

Essentially, those late reply respondents are theoretically comparable to non-response characteristics and suggest that Armstrong and Overton method should be applied (Mooi and Sarstedt, 2011). In addition, this argument was endorsed that the late respondents possibly would not have responded if no an action of followed up.

Non-response bias is a critical disturbance to this study; therefore, a non-response bias test was performed on those late respondents. In accordance to the above assertion, the independent sample test by applying the Levene's Test for Equality of Variances has been used to examine whether the early and late respondent groups reveal any dissimilarities. From the analysis result, if the significant value is greater than 0.05, it suggests no significant differences between the two group of respondents.

Table 5.3
The test result of non-response bias in CGL-Singapore

Variable				Levene's Test for Equality of Variances		T-Test for Equality of Means
		N	Mean	F	Sig.	Sig. (2-tailed)
SSR	Early	108	3.1944	0.216	0.642	0.679
	Late	76	3.2632			0.678
STR	Early	108	3.1806	0.237	0.627	0.759
	Late	76	3.2204			0.760
ICT	Early	108	3.3889	0.040	0.841	0.639
	Late	76	3.4474			0.641
IRP	Early	108	3.1019	0.744	0.390	0.897
	Late	76	3.1184			0.899
TAN	Early	108	3.5116	0.425	0.515	0.810
	Late	76	3.5428			0.809
REL	Early	108	3.6278	0.013	0.908	0.978
	Late	76	3.6316			0.979
RES	Early	108	3.3117	0.458	0.499	0.737
	Late	76	3.2588			0.734
ASS	Early	108	3.4375	0.504	0.479	0.835
	Late	76	3.4013			0.837
EMP	Early	108	3.2616	0.076	0.783	0.884
	Late	76	3.2862			0.885
SAT	Early	108	3.1852	0.283	0.595	0.718
	Late	76	3.1349			0.721
IBS	Early	108	3.0532	0.505	0.478	0.273
	Late	76	3.2434			0.278

*P<0.05

Note: SSR = System-related; STR = Task-related; ICT = Context; IRP = Representation; TAN = Tangibility; REL = Reliability; RES = Responsiveness; ASS = Assurance; EMP = Empathy; SAT = User Satisfaction; IBS = Individual Benefits.

For CGL-Singapore, the first group of 108 usable questionnaires which were collected within the first week of June 2018 was deliberated as early respondents. On the other hand, the second group of 76 usable questionnaires obtained after the first week of June 2018 was marked as late respondents. The results from the Independent Samples T-Test are shown in Table 5.3. In addition, the result demonstrated no statistically significant differences at the 0.05 level for any of the characteristics of the said two groups that is early respondents and late respondents. From the result, the present study concluded that non-response bias was not a critical concern for CGL-Singapore.

Table 5.4
The test result of non-response bias in SLB-Malaysia

Variable				Levene's Test for Equality of Variances		T-Test for Equality of Means
		N	Mean	F	Sig.	Sig. (2-tailed)
SSR	Early	115	3.3478	0.642	0.424	0.855
	Late	65	3.3192			0.859
STR	Early	115	3.2739	0.145	0.703	0.880
	Late	65	3.2538			0.876
ICT	Early	115	3.5188	0.265	0.608	0.236
	Late	65	3.3795			0.247
IRP	Early	115	3.1826	0.242	0.624	0.560
	Late	65	3.1077			0.564
TAN	Early	115	3.6065	2.633	0.106	0.846
	Late	65	3.6308			0.852
REL	Early	115	3.7913	3.786	0.053	0.927
	Late	65	3.8031			0.931
RES	Early	115	3.3942	1.232	0.268	0.675
	Late	65	3.3282			0.683
ASS	Early	115	3.6109	1.736	0.198	0.765
	Late	65	3.5615			0.780
EMP	Early	115	3.4457	1.520	0.219	0.438
	Late	65	3.3269			0.456
SAT	Early	115	3.2783	3.177	0.076	0.802
	Late	65	3.3115			0.809
IBS	Early	115	3.1609	1.773	0.185	0.726
	Late	65	3.2192			0.732

*P<0.05
Note: SSR = System-related; STR = Task-related; ICT = Context; IRP = Representation; TAN = Tangibility; REL = Reliability; RES = Responsiveness; ASS = Assurance; EMP = Empathy; SAT = User Satisfaction; IBS = Individual Benefits.

On the other hand, for SLB-Malaysia, the first group of 115 usable questionnaires which were collected within the first week of June 2018 was deliberated as early respondents. Whereas, the second group of 65 usable questionnaires obtained after the first week of June 2018 was marked as late respondents. The results from the Independent Samples T-Test are shown in Table 5.4. In addition, the result demonstrated no statistically significant differences at the 0.05 level for any of the characteristics of the said two groups that is early respondents and late respondents. From the result, the present study concluded that non-response bias was not critical for SLB-Malaysia in the present study.

5.2.3 Profile of the respondents

By benefiting the descriptive analysis from using SPSS technique, this sub-heading deliberates the profile of the study's respondents as underlying in the provided 8 items. First of all, the respondents were required to name which country of CordLife Group that they currently based. Subsequently, followed by the rest of groups of the respondents' characteristics that is the department, gender, age, the highest education, level of position, which HERP they are currently using and how long been using the HERP. The demographic profiles details of the respondents were elaborated in Table 5.5, for CGL-Singapore and SLB-Malaysia.

Table 5.5 depicts there were 184 and 180 respondents from CGL-Singapore and SLB-Malaysia, respectively. For CGL-Singapore, in the gender perspective, the percentage of respondents amongst female denotes marginally higher than male respondents which represent 64.13% and 35.87%, respectively. Whereas, in age dimension, the majority of respondents' age observed in this study comes from 31-40 years old (39.67%) and followed by respondents' age between 26-30 years old (20.11%). In general, the respondents of this study were among university-level education. In addition, the respondents that graduated with bachelor degree had documented the highest contribution in the present study commensurate with 53.26% and diploma holder respondents equal to 17.93%. Meanwhile, in characteristics of the position level, the respondents amongst executive level was the highest with 72.28% and followed by respondents in managerial position with 12.50%. Widely part of respondents using Microsoft® Dynamics NAVISION 63.59% if compared to the CRM application. In the frequency analysis with respect to the respondents on the HERP usage duration implies

respondents with 2-3 years was the highest group commensurate to this study at 67.93%. Then, followed by 13.04% of the respondents those with 3-4 years and respondents with more than 4 years of service usage duration at 9.24%.

Table 5.5
The demographic profile of the study's respondents from CGL-Singapore and SLB-Malaysia

Demographic	Characteristic	CGL-Singapore		SLB-Malaysia	
		Frequency	Percentage	Frequency	Percentage
Country	Singapore | Malaysia	184	100.00%	180	100.00%
Department	Management	20	10.87%	17	9.44%
	Sales	78	42.39%	88	48.89%
	Marketing	11	5.98%	13	7.22%
	Customer Management	20	10.87%	13	7.22%
	Finance	20	10.87%	13	8.33%
	Fulfillment	19	10.33%	20	11.11%
	Laboratory	16	8.70%	14	7.78%
Gender	Male	66	35.87%	74	41.11%
	Female	118	64.13%	106	58.89%
Age	25 or below	21	11.41%	23	12.78%
	26 – 30	37	20.11%	39	21.67%
	31 – 40	73	39.67%	77	42.78%
	41 – 50	37	20.11%	27	15.00%
	Above 50	16	8.70%	14	7.78%
Highest Education	SPM/O Level	2	1.09%	2	1.11%
	Certificate	23	12.50%	17	9.45%
	Diploma	33	17.93%	39	21.67%
	Degree	98	53.26%	114	63.33%
	Master	20	10.87%	4	2.22%
	Doctoral	8	4.35%	4	2.22%
Position Level	Non-Executive	11	5.98%	17	9.45%
	Executive	133	72.28%	142	78.89%
	Managerial	23	12.50%	18	10.00%
	Director/CEO/Top Management	17	9.24%	3	1.67%
HERP System	Microsoft® Dynamics CRM	63	34.24%	53	29.45%
	Microsoft® Dynamics NAVISION	117	63.59%	125	69.45%
	Others	4	2.17%	2	1.11%
Usage Duration	1 year or less	10	5.43%	12	6.67%
	More than 1 - 2 years	8	4.35%	10	5.56%
	More than 2 - 3 years	125	67.93%	127	70.56%
	More than 3 - 4 years	24	13.04%	18	10.00%
	More than 4 years	17	9.24%	13	7.23%

On the other hand, Table 5.5 depicts there were 180 respondents from SLB-Malaysia in total. In the gender perspective, the percentage of respondents amongst female denotes marginally higher than male respondents which represent 58.89% and 41.11%,

respectively. Whereas, in age dimension, the majority of respondents' age observed in this study comes from 31-40 years old (42.78%) and followed by respondents' age between 26-30 years old (21.67%). In general, the respondents of this study were among university-level education. In addition, the respondents that graduated with bachelor degree had documented the highest contribution in the present study equal to 63.33% and next by diploma holder respondents with 21.67%. Meanwhile, in characteristics of the position level, the respondents amongst executive level was the highest with 78.89% and followed by respondents in managerial position with 10.0%.

Widely part of respondents using Microsoft® Dynamics NAVISION 69.45% if compared to the CRM application. In the frequency analysis with respect to the respondents on the HERP usage duration implies respondents with 2-3 years was the highest group commensurate to this study at 70.56%. Subsequently, followed by 10.0% of the respondents those with 3-4 years and respondents with more than 4 years of service usage duration at 7.23%.

5.3 Data screening analysis

Data screening was a compulsory process and fundamental step in the research study. This process to evaluate the study's data before analysing the impact of the research framework in the specific research area. The necessary for undertaking data screening procedure was emphasised in the research methodology articles due to the erroneous and bad quality of data distribution can mislead analysis approaches and outcomes (Tabachnick & Fidell, 2013). Even though the PLS-SEM was applied in the present study with the purpose to assess the model quality throughout the evaluation result of the

measurement model and structural model. However, the other measurement aspect that less sensitive, such as data normality and data screening were used because the characteristic of the distribution of the data can be examined. Therefore, the major intention of these screening process is to identify and resolve the best practices to treat with any excessive data that come across. Subsequently, in this technique, finding and handling of missing data, outliers, normality, linear relationship and test of homoscedasticity were run, accordingly.

5.3.1 Treatment of missing data

Essentially, wrong entry or no answer to a specific item within the data group lead to missing data. Therefore, further extra detection and analysis are needed. The consequences due to missing data in data analysis are serious, thus, the necessary steps were taken to prevent their existence. In accordance, after receiving the completed questionnaires, overall items in the surveys or questionnaires were examined absolutely to guarantee that the whole questions were correctly answered. Subsequently, descriptive statistical analysis of data was executed to discover the existence of missing data after the collected research data totally inputted into SPSS software. The descriptive result helps to examine that there was complete data in the surveys or questionnaires. None the less, there were in total 31 excluded questionnaires because of incompleteness, straight lining answer and outside of the targeted respondents, which were consequently rejected from the next level of data analysis processes.

5.3.2 Assessment of outliers

The next level up of the data screening process is the assessment and handling of outliers with the intention of detecting excessive value that could lead to the destructive effect upon statistical calculation. Generally, those abnormally high or low values that resulted from a variable or a mixture of numerous variables which the observation emerged compared to the rest of the others was defined as outlier cases. Hence, the multivariate analysis by means of Mahalanobis Distance is commonly applied to ascertain and handle the outlying cases appropriately (Tabachnick & Fidell, 2013).

Tabachnick and Fidell (2013) implied that in order to spot and handle the multivariate outlying cases effectively, Mahalanobis Distance (D^2) was the suitable method to be applied. In addition, the Mahalanobis technique is available from the SPSS software. Subsequently, the results were evaluated against Chi-square's table (see Appendix G). Given that 10 independent variables were employed, signifying the degree of freedom (df) in the X^2 table with $p < 0.001$, so the criteria value was 29.59 (Tabachnick & Fidell, 2013). This translates that any case with a D^2 of 29.59 and above is considered as a multivariate outlier and the respondents should be rejected in further analysis.

After a thorough Mahalanobis test was conducted, for CGL-Singapore, the highest value of D^2 was 25.21. Whereas, for SLB-Malaysia, the highest value of D^2 was 28.79. Luckily, no cases were found about 29.59 and above, therefore, a total of 184 and 180 each group sample can proceed for further data analysis. In a nutshell, the results of the D^2 (MAH_1 in SPSS) CGL-Singapore and (MAH_2 in SPSS) SLB-Malaysia were depicted in Appendix E and Appendix F, respectively.

5.3.3 Assessment of normality

Normality assessment illustrates a balanced bell-shaped curve that the highest frequency marks positioning in the middle and followed by the rest of the lower frequency marks directing to the excesses (Pallant, 2011).

With the aim to calculate the normality, in a total of five measures need to be applied. Firstly, the histogram that showcases the normal probability plot should be produced in order to evaluate the range of data distribution. Then followed by calculation results from standard deviation, mean, skewness and lastly the value from kurtosis. In addition, a postulation with normality describes the data distribution of continuous variable marks alongside normal curve was demonstrated by the histogram.

Standard deviation is explained as an assessment of the pattern in the data are spread. It is the average distance of the data distribution from the mean. It describes the level of variation from the mean, with a low value of standard deviation indicating data that is neighbouring to the mean. Contrary, a high value of standard deviation implying the distribution of data is beyond a spread of values. On the other hand, skewness and kurtosis, Kline (2011) argued that a skewness index is acceptable when a value is less than 3.0 wherein the kurtosis index is recommended to be less than 8.0 it would be acceptable. In the present study, the skewness and kurtosis values were obtained inside the suggested scope and depicted in Table 5.6 and Table 5.7, CGL-Singapore and SLB-Malaysia, respectively.

Table 5.6
Descriptive statistics of mean, standard deviation, skewness and kurtosis for study Variables (n = 184) for CGL-Singapore

Variable	Mean	Std. Deviation	Skewness		Kurtosis	
			Statistic	Std. Error	Statistic	Std. Error
SSR	3.2228	0.0814	-0.406	0.179	-0.586	0.356
STR	3.1970	0.0637	-0.048	0.179	-0.702	0.356
ICT	3.4130	0.0612	-0.660	0.179	-0.225	0.356
IRP	3.1087	0.0629	-0.331	0.179	-0.576	0.356
TAN	3.5245	0.0638	-0.553	0.179	-0.235	0.356
REL	3.6293	0.0692	-0.450	0.179	-0.938	0.356
RES	3.2899	0.0772	-0.392	0.179	-0.656	0.356
ASS	3.4226	0.0854	-0.719	0.179	-0.533	0.356
EMP	3.2717	0.0825	-0.456	0.179	-0.671	0.356
SAT	3.1644	0.0684	-0.379	0.179	-0.798	0.356
IBS	3.1318	0.0852	-0.082	0.179	-1.105	0.356

Note: SSR = System-related; STR = Task-related; ICT = Context; IRP = Representation; TAN = Tangibility; REL = Reliability; RES = Responsiveness; ASS = Assurance; EMP = Empathy; SAT = User Satisfaction; IBS = Individual Benefits.

Table 5.7
Descriptive statistics of mean, standard deviation, skewness and kurtosis for study Variables (n = 180) for SLB-Malaysia

Variable	Mean	Std. Deviation	Skewness		Kurtosis	
			Statistic	Std. Error	Statistic	Std. Error
SSR	3.3375	0.0747	-0.574	0.181	-0.201	0.360
STR	3.2667	0.0637	-0.015	0.181	-0.551	0.360
ICT	3.4685	0.0563	-0.691	0.181	-0.225	0.360
IRP	3.1556	0.0614	-0.531	0.181	-0.017	0.360
TAN	3.6153	0.0597	-0.677	0.181	-0.352	0.360
REL	3.7956	0.0616	-0.772	0.181	-0.206	0.360
RES	3.3704	0.0752	-0.504	0.181	-0.452	0.360
ASS	3.5931	0.0789	-0.930	0.181	-0.058	0.360
EMP	3.4028	0.0733	-0.715	0.181	-0.061	0.360
SAT	3.2903	0.0636	-0.380	0.181	-0.356	0.360
IBS	3.1819	0.0796	-0.038	0.181	-1.034	0.360

Note: SSR = System-related; STR = Task-related; ICT = Context; IRP = Representation; TAN = Tangibility; REL = Reliability; RES = Responsiveness; ASS = Assurance; EMP = Empathy; SAT = User Satisfaction; IBS = Individual Benefits.

However, any challenges associated with normality distribution are relatively less severe when employing PLS-SEM (Hair *et al.*, 2014a). Subsequently, PLS-SEM uses the bootstrapping method for ascertaining any significant relationship within a model for non-normal data. This is one of the main advantages of PLS-SEM application. Despite

such benefit, Hair *et al.* (2014a) argued a thorough inspection of the data to assure extreme deviation could be detected and discarded before running PLS-SEM. This intended to preserve good quality, particularly among the data and outcome of this study. Fortunately, upon inspection of five measures of normality evaluation, no indication of extreme non-normal data was found and can proceed using the existing data set was for further analysis.

5.4 Descriptive analysis

A descriptive analysis was executed to explain the general HERP users' perception of SQ, SVQ, IQ, SAT and IBS with regard to the HERP. Then, the results shown in Table 5.8 and Table 5.9, for CGL-Singapore and SLB-Malaysia, respectively.

In accordance, the mean, standard deviation, maximum and minimum of the constructs were reported. For simplicity of understanding of the 5-point Likert scale, the present study utilised five equal-sized categories as follows: scores less than 2.20 [6/5 + lowest values (1)] were viewed as low; scores of 3.80 [highest value (5) - 6/5] high and those in between considered as moderate scores. Table 5.8 and Table 5.9 depict that the minimum and maximum values for each construct were 1.00 and 5.00 individually, which proportionate to the minimum and maximum degrees in the Likert scale utilised in this study.

Table 5.8
Descriptive analysis of the variables (n = 184) for CGL-Singapore

Variable	Mean	Std. Deviation	Minimum	Maximum
SSR	3.2228	0.0814	1.000	5.000
STR	3.1970	0.0637	1.000	5.000
ICT	3.4130	0.0612	1.333	4.750
IRP	3.1087	0.0629	1.000	5.000
TAN	3.5245	0.0638	1.250	5.000
REL	3.6293	0.0692	1.600	5.000
RES	3.2899	0.0772	1.000	4.800
ASS	3.4226	0.0854	1.000	5.000
EMP	3.2717	0.0825	1.000	5.000
SAT	3.1644	0.0684	1.250	5.000
IBS	3.1318	0.0852	1.000	5.000

Note: SSR = System-related; STR = Task-related; ICT = Context; IRP = Representation; TAN = Tangibility; REL = Reliability; RES = Responsiveness; ASS = Assurance; EMP = Empathy; SAT = User Satisfaction; IBS = Individual Benefits.

Table 5.9
Descriptive analysis of the variables (n = 180) for SLB-Malaysia

Variable	Mean	Std. Deviation	Minimum	Maximum
SSR	3.3375	0.0747	1.000	4.500
STR	3.2667	0.0637	1.250	5.000
ICT	3.4685	0.0563	1.000	5.000
IRP	3.1556	0.0614	1.000	5.000
TAN	3.6153	0.0597	1.500	5.000
REL	3.7956	0.0616	1.000	5.000
RES	3.3704	0.0752	1.500	5.000
ASS	3.5931	0.0789	1.250	5.000
EMP	3.4028	0.0733	1.000	5.000
SAT	3.2903	0.0636	1.000	4.750
IBS	3.1819	0.0796	1.000	5.000

Note: SSR = System-related; STR = Task-related; ICT = Context; IRP = Representation; TAN = Tangibility; REL = Reliability; RES = Responsiveness; ASS = Assurance; EMP = Empathy; SAT = User Satisfaction; IBS = Individual Benefits.

For the Table 5.8, CGL-Singapore, the data shown that REL dimension of SVQ had the maximum mean value of 3.6293 with the standard deviation of 0.0692. In opposite, IRP dimension of IQ had the minimum mean value of 3.1087 with the standard deviation of 0.0629. In general, these results showed that the respondents tended to display a moderate level response to all measured variables. While SAT as independent variable

got the mean score of 3.1644. These mean scores can be translated that the HERP users' response on satisfaction stood at the moderate level among the HERP users. The mean scores for the variables of SVQ obtained 3.3481 slightly higher scores compare variables for SQ at 3.2103 and IQ at 3.2614. More effort highlights the improvement of SQ and IQ initiatives as an input to the HERP-based services may lead to better score results of SQ, SVQ, IQ, SAT and IBS.

On the other hand, for the Table 5.9, SLB-Malaysia, the data shown that REL dimension of SVQ had the maximum mean value of 3.7956 with the standard deviation of 0.616. In opposite, IRP dimension of IQ had the minimum mean value of 3.1556 with the standard deviation of 0.0614. In general, these results showed that the respondents tended to display a moderate level response to all measured variables. While SAT as independent variable got the mean score of 3.2903. These mean scores can be translated that the HERP users' response on satisfaction stood at the moderate level among the HERP users. The mean scores for the variables of SVQ obtained 3.4642 slightly higher scores compare variables for SQ at 3.3021 and IQ at 3.3125. More effort highlights the improvement of SQ and IQ initiatives as an input to the HERP-based services may lead to better score results of SQ, SVQ, IQ, SAT and IBS.

5.5 Evaluation of the model quality

This study utilises SmartPLS version 3.0 software to execute data analysis as this product is the broadly utilised technique in the research (Hair, Sarstedt, Ringle & Mena, 2012b). Additionally, PLS-SEM path model investigated and translated in two phases, namely measurement model and structural model (Hair *et al.*, 2014a). Firstly, the outer

model or measurement model is analysed to guarantee its validity and reliability between constructs and indicators. Measurement characteristics on the constructs with multiple-item are comprised of convergent validity, discriminant validity and reliability.

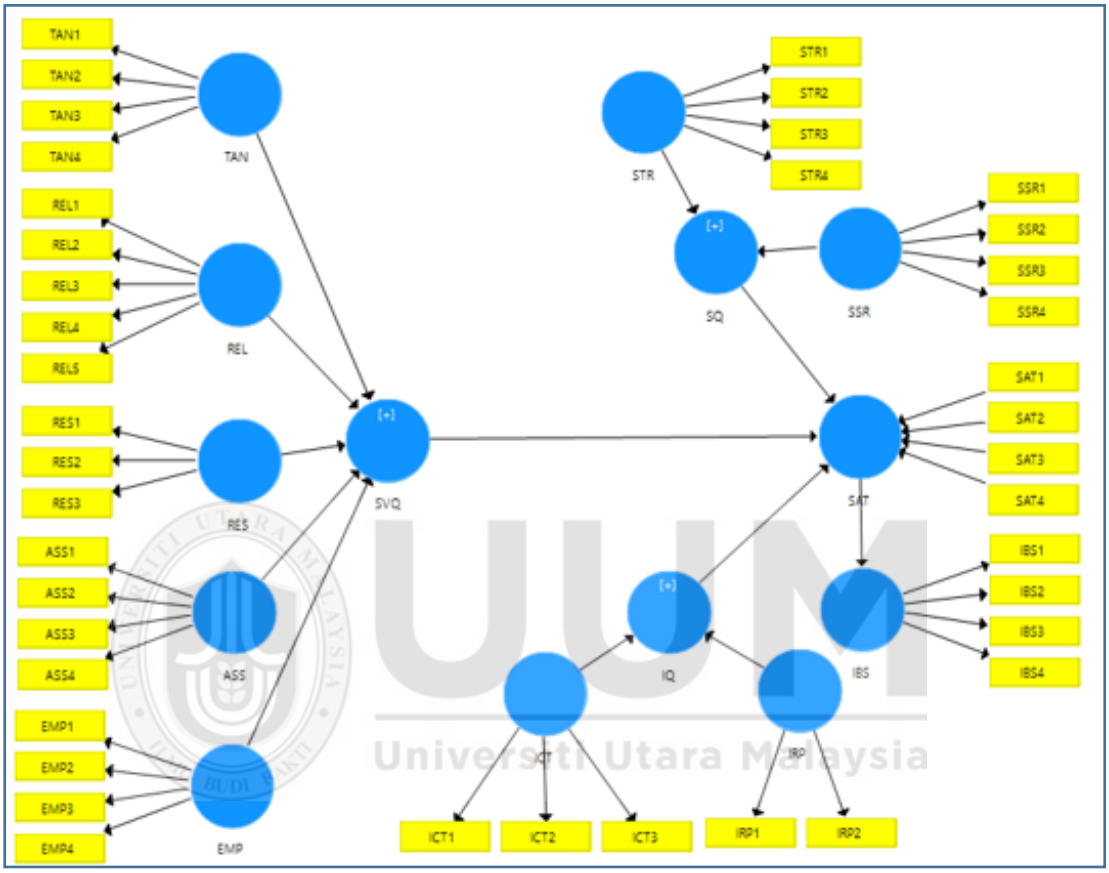

Figure 5.1
Original Research Framework
Note: SSR = System-related; STR = Task-related; ICT = Context; IRP = Representation; TAN = Tangibility; REL = Reliability; RES = Responsiveness; ASS = Assurance; EMP = Empathy; SAT = User Satisfaction; IBS = Individual Benefits.

Multicollinearity analysis was also a part of the measurement model for formative measurement that adapted for a second-order construct. Secondly, the structural model is also known as the inner model was analysed the relationship between constructs by means of R square (R^2), effect size ($f2$) and predictive relevance of the model (Q^2). In addition, bootstrapping of 5,000 subsamples iteration as argued by Hair *et al.* (2014a) was applied to test the study hypotheses. Essentially, the study model contained 41

measurement items for 11 variables (latent variables) that covers 10 independent variables, 3 latent constructs at the second-order construct and 1 dependent variable which constitutes 4 hypotheses for relationships between them and supported by the D&M ISSM (2003) as outlined in Figure 5.1.

5.5.1 Measurement model

The initial phase in PLS-SEM path modelling is to validate the measurement model that utilised in this study. This first step is to decide how good the indicators are fitting to the constructs that theoretically designed. Therefore, scrutinising the outer model to assure those questionnaire items measure the constructs that meant to measure. The main purpose of guaranteeing the questionnaire instrument is reliable. Subsequently, in order to decide each item reliabilities, this study examined at each loading to those variables. For the goal of the testing goodness of measure, the two foremost criteria utilised are validity and reliability. In a nutshell, validity is intended to test how well the instruments utilised in the research measure the proposed concept.

5.5.1.1 Validity test

Validity implies the assessment's accuracy, regardless of whether the theoretical or practical implications are the genuine manifestation of the fundamental concept to be assessed or not (Neuman, 2003). There are several kinds of validity analysis, such as convergent validity and discriminant validity that applied in the present study.

For CGL-Singapore, two items were discarded from further analysis because item STR4 (0.631) and item REL2 (0.690) were lesser than 0.70. Meanwhile, for SLB-Malaysia, two items were discarded from further analysis because item STR4 (0.520) and item

Table 5.10
Loading and cross-loading for CGL-Singapore

Items	ASS	EMP	IBS	ICT	IRP	REL	RES	SAT	SSR	STR	TAN
ASS1	**0.909**	0.744	0.647	0.750	0.714	0.744	0.678	0.805	0.736	0.664	0.696
ASS2	**0.888**	0.733	0.616	0.592	0.579	0.659	0.643	0.731	0.675	0.621	0.671
ASS3	**0.903**	0.755	0.624	0.636	0.668	0.727	0.653	0.770	0.682	0.665	0.655
ASS4	**0.769**	0.633	0.387	0.532	0.534	0.536	0.518	0.566	0.566	0.447	0.553
EMP1	0.697	**0.868**	0.571	0.619	0.633	0.687	0.647	0.709	0.678	0.565	0.652
EMP2	0.751	**0.892**	0.672	0.628	0.649	0.698	0.654	0.751	0.623	0.571	0.623
EMP3	0.718	**0.865**	0.534	0.617	0.591	0.654	0.693	0.736	0.682	0.561	0.577
EMP4	0.623	**0.754**	0.412	0.512	0.512	0.596	0.535	0.571	0.549	0.383	0.488
IBS1	0.615	0.609	**0.859**	0.597	0.556	0.619	0.502	0.699	0.581	0.594	0.640
IBS2	0.539	0.566	**0.836**	0.424	0.414	0.470	0.496	0.588	0.550	0.488	0.560
IBS3	0.504	0.485	**0.837**	0.479	0.497	0.497	0.537	0.608	0.539	0.556	0.578
IBS4	0.545	0.503	**0.788**	0.509	0.549	0.499	0.532	0.571	0.531	0.467	0.477
ICT1	0.628	0.648	0.574	**0.870**	0.669	0.682	0.635	0.722	0.668	0.500	0.598
ICT2	0.618	0.561	0.453	**0.793**	0.569	0.572	0.526	0.673	0.580	0.432	0.581
ICT3	0.553	0.529	0.475	**0.810**	0.527	0.546	0.531	0.662	0.552	0.574	0.551
IRP1	0.544	0.597	0.449	0.641	**0.849**	0.539	0.438	0.566	0.513	0.418	0.402
IRP2	0.711	0.646	0.606	0.623	**0.909**	0.712	0.642	0.717	0.695	0.627	0.651
REL1	0.571	0.539	0.437	0.567	0.545	**0.790**	0.501	0.605	0.626	0.364	0.535
REL2	0.613	0.614	0.435	0.554	0.527	**0.690**	0.453	0.567	0.588	0.362	0.474
REL3	0.446	0.519	0.387	0.448	0.457	**0.727**	0.430	0.499	0.527	0.248	0.495
REL4	0.659	0.650	0.619	0.621	0.617	**0.830**	0.558	0.717	0.647	0.579	0.602
REL5	0.676	0.679	0.532	0.615	0.620	**0.827**	0.624	0.710	0.648	0.573	0.615
RES1	0.641	0.677	0.544	0.549	0.536	0.571	**0.877**	0.682	0.726	0.489	0.635
RES2	0.604	0.650	0.571	0.639	0.544	0.572	**0.878**	0.691	0.691	0.536	0.612
RES3	0.635	0.628	0.502	0.598	0.550	0.603	**0.849**	0.686	0.663	0.602	0.645
SAT1	0.646	0.625	0.617	0.706	0.535	0.598	0.647	**0.819**	0.680	0.649	0.694
SAT2	0.636	0.649	0.542	0.657	0.642	0.666	0.593	**0.754**	0.663	0.567	0.597
SAT3	0.631	0.594	0.604	0.606	0.544	0.635	0.629	**0.787**	0.677	0.588	0.696
SAT4	0.798	0.802	0.675	0.765	0.713	0.767	0.721	**0.915**	0.771	0.676	0.744
SSR1	0.589	0.568	0.478	0.467	0.471	0.631	0.644	0.604	**0.783**	0.440	0.632
SSR2	0.634	0.647	0.535	0.652	0.671	0.694	0.598	0.741	**0.859**	0.539	0.629
SSR3	0.697	0.665	0.631	0.702	0.617	0.658	0.712	0.767	**0.825**	0.548	0.617
SSR4	0.636	0.610	0.554	0.583	0.544	0.636	0.708	0.692	**0.864**	0.474	0.682
STR1	0.621	0.547	0.565	0.583	0.513	0.525	0.532	0.661	0.555	**0.814**	0.621
STR2	0.509	0.462	0.525	0.427	0.436	0.375	0.529	0.586	0.459	**0.786**	0.512
STR3	0.496	0.393	0.437	0.381	0.467	0.378	0.418	0.535	0.368	**0.783**	0.511
STR4	0.472	0.470	0.378	0.427	0.414	0.435	0.396	0.483	0.429	**0.631**	0.501
TAN1	0.631	0.550	0.521	0.536	0.457	0.595	0.540	0.646	0.618	0.557	**0.840**
TAN2	0.565	0.489	0.446	0.418	0.365	0.437	0.428	0.539	0.436	0.531	**0.748**
TAN3	0.585	0.564	0.615	0.620	0.537	0.566	0.633	0.716	0.641	0.619	**0.758**
TAN4	0.539	0.551	0.526	0.577	0.528	0.587	0.632	0.676	0.662	0.505	**0.771**

Note: SSR = System-related; STR = Task-related; ICT = Context; IRP = Representation; TAN = Tangibility; REL = Reliability; RES = Responsiveness; ASS = Assurance; EMP = Empathy; SAT = User Satisfaction; IBS = Individual Benefits.

Table 5.11
Loading and cross-loading for SLB-Malaysia

Items	ASS	EMP	IBS	ICT	IRP	REL	RES	SAT	SSR	STR	TAN
ASS1	**0.802**	0.727	0.624	0.533	0.562	0.539	0.648	0.665	0.752	0.426	0.573
ASS2	**0.858**	0.758	0.721	0.571	0.693	0.702	0.695	0.764	0.769	0.602	0.622
ASS3	**0.874**	0.719	0.730	0.563	0.687	0.664	0.684	0.694	0.727	0.525	0.638
ASS4	**0.862**	0.729	0.607	0.573	0.609	0.639	0.637	0.632	0.698	0.470	0.572
EMP1	0.745	**0.889**	0.724	0.610	0.714	0.596	0.715	0.685	0.709	0.575	0.599
EMP2	0.800	**0.883**	0.731	0.616	0.754	0.725	0.679	0.776	0.764	0.630	0.610
EMP3	0.718	**0.865**	0.736	0.573	0.621	0.560	0.679	0.714	0.697	0.620	0.567
EMP4	0.690	**0.783**	0.639	0.528	0.697	0.505	0.614	0.604	0.656	0.520	0.567
IBS1	0.661	0.681	**0.810**	0.550	0.622	0.583	0.633	0.709	0.669	0.533	0.609
IBS2	0.636	0.660	**0.833**	0.486	0.670	0.618	0.719	0.698	0.673	0.567	0.584
IBS3	0.560	0.597	**0.750**	0.406	0.597	0.593	0.495	0.633	0.573	0.593	0.480
IBS4	0.659	0.690	**0.779**	0.452	0.608	0.580	0.654	0.644	0.642	0.452	0.476
ICT1	0.561	0.583	0.494	**0.818**	0.557	0.499	0.545	0.587	0.471	0.460	0.479
ICT2	0.507	0.501	0.466	**0.798**	0.534	0.485	0.505	0.542	0.469	0.375	0.531
ICT3	0.532	0.567	0.494	**0.813**	0.562	0.460	0.494	0.577	0.545	0.492	0.710
IRP1	0.667	0.721	0.694	0.606	**0.903**	0.597	0.668	0.697	0.687	0.557	0.513
IRP2	0.698	0.750	0.730	0.627	**0.907**	0.584	0.643	0.714	0.700	0.688	0.606
REL1	0.573	0.495	0.522	0.397	0.466	**0.788**	0.538	0.530	0.537	0.342	0.480
REL2	0.519	0.511	0.479	0.426	0.444	**0.719**	0.432	0.548	0.492	0.370	0.373
REL3	0.552	0.524	0.574	0.462	0.499	**0.816**	0.531	0.583	0.490	0.340	0.457
REL4	0.606	0.561	0.674	0.493	0.535	**0.835**	0.553	0.666	0.650	0.407	0.466
REL5	0.723	0.685	0.692	0.566	0.631	**0.816**	0.570	0.666	0.617	0.483	0.538
RES1	0.718	0.678	0.670	0.548	0.672	0.577	**0.867**	0.629	0.721	0.507	0.556
RES2	0.660	0.699	0.714	0.553	0.622	0.588	**0.879**	0.735	0.703	0.486	0.589
RES3	0.707	0.700	0.705	0.582	0.629	0.586	**0.900**	0.709	0.769	0.509	0.659
SAT1	0.712	0.707	0.692	0.551	0.644	0.623	0.667	**0.819**	0.717	0.538	0.580
SAT2	0.627	0.686	0.651	0.616	0.624	0.615	0.600	**0.782**	0.631	0.510	0.685
SAT3	0.610	0.619	0.704	0.494	0.606	0.619	0.579	**0.799**	0.652	0.550	0.551
SAT4	0.720	0.694	0.750	0.645	0.694	0.658	0.716	**0.894**	0.747	0.680	0.658
SSR1	0.781	0.721	0.681	0.601	0.735	0.613	0.762	0.723	**0.849**	0.592	0.650
SSR2	0.703	0.699	0.629	0.482	0.567	0.487	0.649	0.675	**0.845**	0.477	0.610
SSR3	0.739	0.730	0.718	0.486	0.677	0.614	0.745	0.753	**0.875**	0.486	0.606
SSR4	0.742	0.673	0.723	0.519	0.631	0.688	0.667	0.707	**0.845**	0.537	0.642
STR1	0.489	0.546	0.569	0.477	0.617	0.436	0.419	0.617	0.539	**0.818**	0.511
STR2	0.446	0.493	0.561	0.425	0.517	0.308	0.451	0.517	0.459	**0.748**	0.468
STR3	0.491	0.610	0.513	0.420	0.536	0.376	0.450	0.552	0.506	**0.822**	0.474
STR4	0.323	0.347	0.303	0.259	0.306	0.333	0.361	0.345	0.246	**0.520**	0.290
TAN1	0.543	0.528	0.493	0.494	0.456	0.468	0.543	0.456	0.555	0.366	**0.718**
TAN2	0.398	0.360	0.418	0.465	0.387	0.343	0.453	0.457	0.362	0.407	**0.684**
TAN3	0.551	0.534	0.497	0.648	0.529	0.403	0.454	0.610	0.559	0.494	**0.811**
TAN4	0.646	0.632	0.640	0.546	0.506	0.551	0.630	0.698	0.715	0.544	**0.830**

Note: SSR = System-related; STR = Task-related; ICT = Context; IRP = Representation; TAN = Tangibility; REL = Reliability; RES = Responsiveness; ASS = Assurance; EMP = Empathy; SAT = User Satisfaction; IBS = Individual Benefits.

TAN2 (0.684) were lesser than 0.70. After removal of these items, all the leftover items that evaluated a specific construct loaded extremely but those items loaded lower for other constructs. Therefore, endorsing construct validity of the present study. Succinctly, Table 5.10 and Table 5.11 show the cross-loading result for CGL-Singapore and SLB-Malaysia, respectively.

5.5.1.2 Convergent validity

Essentially, convergent validity described as evaluation of relationships between two measures of the particular concept is correlated (Hair *et al.*, 2014b). In addition, the researchers recommend that the factor loadings, composite reliability (CR) and average variance extracted (AVE) are utilised to evaluate convergent validity. Therefore, all the item loadings should be greater than 0.70, the suggested value (Hair *et al.*, 2014a).

Additionally, composite reliability values imply the level to which the construct indicators specify the latent variable and they should be greater than 0.70, as recommended by prior researchers (Hair *et al.,* 2014a). In the present study, for CGL-Singapore, composite reliability values varied from 0.842 to 0.925, as depicted in Table 5.12. Therefore, signifying good internal consistency reliability. The average variance extracted (AVE) evaluates the variance shown by the indicators relative to measurement error and loading value higher than 0.50 was suggested to rationalise the usage of the construct (Hair *et al.,* 2014a). Meanwhile, for SLB-Malaysia, the AVEs varied from 0.543 to 0.819, which were all within the suggested range as depicted in Table 5.13. Consequently, the whole latent variables fulfilled the threshold value and were deliberated to have fulfilled the standard suggested for convergent validity.

Table 5.12
Convergent validity and measurement model for CGL-Singapore

Variable	Item	Loading	Average Variance Extracted (AVE)	Composite Reliability (CR)
System-related (SSR)	SSR1	**0.783**	0.694	0.901
	SSR2	**0.859**		
	SSR3	**0.825**		
	SSR4	**0.864**		
Task-related (STR)	STR1	**0.814**	0.573	0.842
	STR2	**0.786**		
	STR3	**0.783**		
	~~STR4~~	~~**0.631**~~		
Context (ICT)	ICT1	**0.870**	0.680	0.864
	ICT2	**0.793**		
	ICT3	**0.810**		
Representation (IRP)	IRP1	**0.849**	0.773	0.872
	IRP2	**0.909**		
Tangibility (TAN)	TAN1	**0.840**	0.609	0.861
	TAN2	**0.748**		
	TAN3	**0.758**		
	TAN4	**0.771**		
Reliability (REL)	REL1	**0.790**	0.600	0.882
	~~REL2~~	~~**0.690**~~		
	REL3	**0.727**		
	REL4	**0.830**		
	REL5	**0.827**		
Responsiveness (RES)	RES1	**0.877**	0.754	0.902
	RES2	**0.878**		
	RES3	**0.849**		
Assurance (ASS)	ASS1	**0.909**	0.755	0.925
	ASS2	**0.888**		
	ASS3	**0.903**		
	ASS4	**0.769**		
Empathy (EMP)	EMP1	**0.868**	0.716	0.910
	EMP2	**0.892**		
	EMP3	**0.865**		
	EMP4	**0.754**		
Individual Benefits (IBS)	IBS1	**0.859**	0.690	0.899
	IBS2	**0.836**		
	IBS3	**0.837**		
	IBS4	**0.788**		

Table 5.13
Convergent validity and measurement model for SLB-Malaysia

Variable	Item	Loading	Average Variance Extracted (AVE)	Composite Reliability (CR)
System-related (SSR)	SSR1	**0.849**	0.723	0.913
	SSR2	**0.845**		
	SSR3	**0.875**		
	SSR4	**0.845**		
Task-related (STR)	STR1	**0.818**	0.543	0.822
	STR2	**0.748**		
	STR3	**0.822**		
	~~STR4~~	~~**0.520**~~		
Context (ICT)	ICT1	**0.830**	0.655	0.851
	ICT2	**0.799**		
	ICT3	**0.818**		
Representation (IRP)	IRP1	**0.872**	0.819	0.900
	IRP2	**0.905**		
Tangibility (TAN)	TAN1	**0.718**	0.583	0.847
	~~TAN2~~	~~**0.684**~~		
	TAN3	**0.811**		
	TAN4	**0.830**		
Reliability (REL)	REL1	**0.788**	0.634	0.896
	REL2	**0.719**		
	REL3	**0.816**		
	REL4	**0.835**		
	REL5	**0.816**		
Responsiveness (RES)	RES1	**0.867**	0.778	0.913
	RES2	**0.879**		
	RES3	**0.900**		
Assurance (ASS)	ASS1	**0.802**	0.722	0.912
	ASS2	**0.858**		
	ASS3	**0.874**		
	ASS4	**0.862**		
Empathy (EMP)	EMP1	**0.889**	0.733	0.916
	EMP2	**0.883**		
	EMP3	**0.865**		
	EMP4	**0.783**		
Individual Benefits (IBS)	IBS1	**0.810**	0.630	0.872
	IBS2	**0.833**		
	IBS3	**0.750**		
	IBS4	**0.779**		

5.5.1.3 Discriminant validity

Discriminant validity of the measures is the level to which items varying amongst constructs or measure different concepts. By the way, Hair *et al.* (2014a) elaborated that discriminant validity specifies each latent construct's average variance extracted (AVE)

Table 5.14
Fornell and Larcker Criterion: Assessment results of second-order construct for CGL-Singapore

Construct	AVE	IBS	IQ	SAT	SQ	SVQ
IBS	0.690	**0.830**				
IQ		0.648	**FORMATIVE**			
SAT		0.746	0.855	**FORMATIVE**		
SQ		0.725	0.796	0.900	**FORMATIVE**	
SVQ		0.736	0.834	0.923	0.906	**FORMATIVE**

Note: IQ = Information Quality; SQ = System Quality; SVQ = Service Quality; SAT = User Satisfaction; IBS = Individual Benefits.

Table 5.15
Fornell and Larcker Criterion: Assessment results of second-order construct for SLB-Malaysia

Construct	AVE	IBS	IQ	SAT	SQ	SVQ
IBS	0.630	**0.794**				
IQ		0.779	**FORMATIVE**			
SAT		0.846	0.815	**FORMATIVE**		
SQ		0.839	0.816	0.872	**FORMATIVE**	
SVQ		0.873	0.853	0.890	0.902	**FORMATIVE**

Note: IQ = Information Quality; SQ = System Quality; SVQ = Service Quality; SAT = User Satisfaction; IBS = Individual Benefits.

should be greater than the highest squared correlation of other latent constructs as suggested by Fornell–Larcker's (1981) benchmark and the item's loadings should be higher than all its cross-loadings. The questionnaire items comprise in TAN, REL, RES, ASS and EMP were examined in order to spot any comparable meaning among the items for SVQ construct; SSR and STR for SQ construct; ICT and IRP for IQ construct. After reviewing the procedure, each item was reflected to have their own unique implication with other items and no item was discarded from the next level analysis procedure. Accordingly, correlation matrix and AVE for each variable had fulfilled Fornell and Larcker's (1981) benchmark and Heterotrait-Monotrait Ratio (HTMT) results as depicted from Table 5.14 to Table 5.17, for CGL-Singapore and SLB-Malaysia, respectively. Therefore, the results confirmed discriminant validity.

Table 5.16
Heterotrait-Monotrait Ratio (HTMT) results for CGL-Singapore

	ASS	EMP	IBS	ICT	IRP	REL	RES	SSR	STR	TAN
ASS										
EMP	**0.938**									
IBS	0.750	**0.751**								
ICT	0.876	0.861	**0.749**							
IRP	0.892	0.897	0.769	**0.973**						
REL	0.882	0.912	0.734	0.906	**0.917**					
RES	0.831	0.878	0.738	0.856	0.797	**0.794**				
SSR	0.876	0.867	0.773	0.891	0.873	0.929	**0.945**			
STR	0.842	0.763	0.787	0.799	0.814	0.695	0.784	**0.746**		
TAN	0.885	0.832	0.821	0.890	0.789	0.859	0.882	0.924	**0.923**	

Note: SSR = System-related; STR = Task-related; ICT = Context; IRP = Representation; TAN = Tangibility; REL = Reliability; RES = Responsiveness; ASS = Assurance; EMP = Empathy; SAT = User Satisfaction; IBS = Individual Benefits.

Table 5.17
Heterotrait-Monotrait Ratio (HTMT) results for SLB-Malaysia

	ASS	EMP	IBS	ICT	IRP	REL	RES	SSR	STR	TAN
ASS										
EMP	**0.986**									
IBS	0.943	**0.985**								
ICT	0.821	0.843	**0.775**							
IRP	0.911	0.985	0.994	**0.898**						
REL	0.863	0.800	0.893	0.743	**0.793**					
RES	0.909	0.905	0.948	0.799	0.889	**0.770**				
SSR	0.992	0.942	0.959	0.761	0.926	0.808	**0.954**			
STR	0.754	0.860	0.880	0.744	0.906	0.631	0.735	**0.757**		
TAN	0.856	0.823	0.852	0.939	0.796	0.714	0.839	0.878	**0.798**	

Note: SSR = System-related; STR = Task-related; ICT = Context; IRP = Representation; TAN = Tangibility; REL = Reliability; RES = Responsiveness; ASS = Assurance; EMP = Empathy; SAT = User Satisfaction; IBS = Individual Benefits.

5.5.2 Assessment of higher-order measurement model

The present study has three constructs to be theorised and evaluated as formative second-order constructs, namely SQ, SVQ and IQ. This assessment to tests whether the scores of the first-order constructs synchronised harmoniously onto their respective second-order constructs. In this manner, the assessment of higher-order measurement model requires steps to measure lower-order latent variables and subsequently, higher-order constructs.

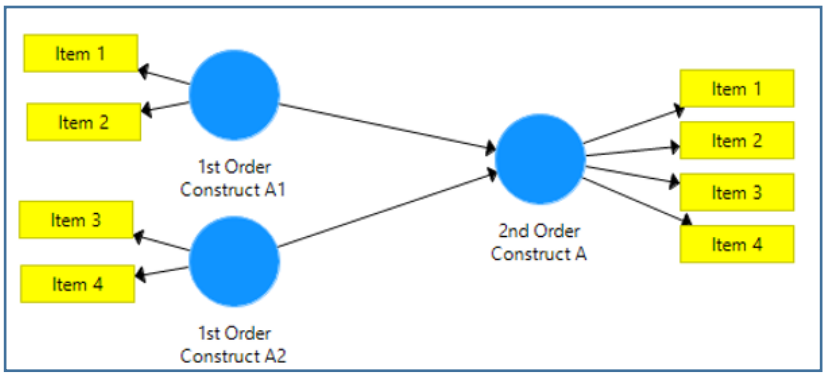

Figure 5.2
Lower-order latent variables model via repeated-indicators approach
Source: adapted from Becker *et al.* (2012)

Referring to Becker *et al.* (2012), three approaches were utilised to measure higher-order construct that is (1) repeated-indicator approach, (2) two-stage approach and (3) hybrid approach. In the present study, the repeated-indicator approach was utilised to assess lower-order latent variables as this approach was generally used by researchers (Hair *et al.*, 2014a). In the first stage, three measurement models, namely SQ, SVQ and IQ were estimated individually as illustrated in Figure 5.2 and the second-order factor was measured by all the lower-order factors where use the latent variables scores as indicators of the latent variables in the interaction model analysis (Becker *et al.*, 2012; Hair *et al.*, 2014a). Unstandardised variable latent scores to represent the lower-order variables were referred and kept throughout this stage of the analysis with the path weighting scheme algorithm in the PLS-SEM analysis. Subsequently, these scores were duplicated into the PLS-SEM data file for facilitating the next data analysis.

In the second stage, these scores were used to denote lower-order variables as indicators for second-order constructs as presented within the structural model. This approach is most usually used (Becker *et al.*, 2012; Wilson, 2011) and was decided for this study.

The outline for second-order construct can be sighted in Figure 5.3. The next subheading presents the formative measurement of higher-order for three constructs namely SQ, SVQ and IQ, including SAT whereas IBS is a reflective construct. This procedure was used to validate the assessed higher-order constructs are reliable, valid and unique between constructs.

5.5.2.1 Analysis of higher-order formative measurement models

With a specific goal to examine the higher-order construct, it is vital to give information relating to the chosen modelling approach and reports for constructs properties (Becker *et al.,* 2012). Furthermore, they recommend that analysis report for a formative model should be included indicator outer weights, the significance of outer weights and multicollinearity of indicators. As mentioned before, the present study chooses reflective-formative modelling approach that fits with the assessed constructs. At higher-order construct level, three constructs namely SQ, SVQ and IQ were measured throughout formative model where five variables coded as TAN, REL, RES, ASS and EMP were conceptualised to shape SVQ construct, two variables coded as SSR and STR were conceptualised to frame SQ construct and another two variables coded as ICT and IRP were conceptualised to model IQ construct. The second model for higher-order construct was depicted in Figure 5.3.

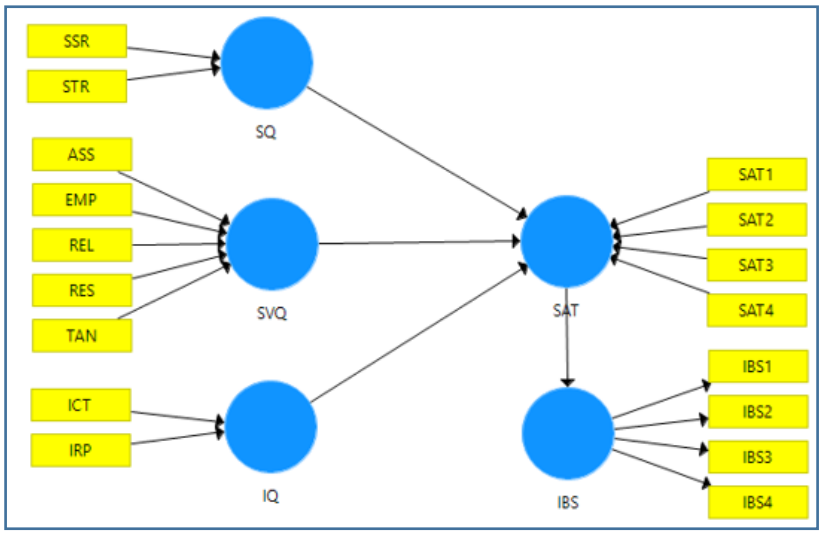

Figure 5.3
Second model for higher-order construct
Note: SSR = System-related; STR = Task-related; ICT = Context; IRP = Representation; TAN = Tangibility; REL = Reliability; RES = Responsiveness; ASS = Assurance; EMP = Empathy; SAT = User Satisfaction; IBS = Individual Benefits.

The unstandardised latent variable scores for lower-order variables were obtained during analysis of lower-order measurement models using path algorithm weighting scheme and 5,000 bootstrapped subsample iterations. These unstandardised latent variable scores were utilised to represent lower-order variables and acted as indicators to their respective constructs. The structural model for second-order constructs was regressed in the similar technique as depicted in Figure 5.4 and Figure 5.5, for CGL-Singapore and SLB-Malaysia, respectively. Another essential point needs to evaluate the formative measurement is collinearity. Assessment of collinearity amongst formative indicators encountered difficulty due to the weights binding the formative indicators with the construct were unstable and non-significant. In addition, there no such individual measurement error terms are reported in the formative indicators (Hair *et al.*, 2014a). Because of the seriousness of collinearity issues, Kock and Lynn (2012) had aggressively recommended that analysis suggesting strong predictor criterion associations be deliberated for full collinearity tests among all constructs in order to

Table 5.18
Assessment results of second-order construct for formative constructs for CGL-Singapore

FORMATIVE	Variable	Outer Weight	T-Value	VIF
System Quality (SQ)	SSR	0.686**	18.002	1.558
	STR	0.425**	9.927	1.558
Information Quality (IQ)	ICT	0.736**	11.522	2.070
	IRP	0.329**	4.599	2.070
Service Quality (SVQ)	TAN	0.347**	4.748	2.865
	REL	0.217**	3.495	3.135
	RES	0.166*	2.460	2.876
	ASS	0.208**	2.566	4.066
	EMP	0.283**	2.657	4.200
User Satisfaction (SAT)	SAT1	0.277**	5.668	1.888
	SAT2	0.128*	2.601	1.937
	SAT3	0.268**	5.749	1.759
	SAT4	0.506**	10.023	2.105

**p<0.05; ** p<0.01; n.s = not significant*
Note: SSR = System-related; STR = Task-related; ICT = Context; IRP = Representation; TAN = Tangibility; REL = Reliability; RES = Responsiveness; ASS = Assurance; EMP = Empathy; SAT = User Satisfaction; IBS = Individual Benefits.

Table 5.19
Assessment results of second-order construct for formative constructs for SLB-Malaysia

FORMATIVE	Variable	Outer Weight	T-Value	VIF
System Quality (SQ)	SSR	0.750**	18.002	1.558
	STR	0.346**	6.694	1.558
Information Quality (IQ)	ICT	0.387**	5.820	1.867
	IRP	0.694**	11.255	1.867
Service Quality (SVQ)	TAN	0.235**	3.700	2.212
	REL	0.274**	4.285	2.396
	RES	0.219**	2.953	3.178
	ASS	0.125*	1.245	5.341
	EMP	0.283**	2.984	4.587
User Satisfaction (SAT)	SAT1	0.333**	4.664	1.793
	SAT2	0.220**	3.941	1.836
	SAT3	0.196**	4.275	1.988
	SAT4	0.443**	6.764	2.026

**p<0.05; ** p<0.01; n.s = not significant*
Note: SSR = System-related; STR = Task-related; ICT = Context; IRP = Representation; TAN = Tangibility; REL = Reliability; RES = Responsiveness; ASS = Assurance; EMP = Empathy; SAT = User Satisfaction; IBS = Individual Benefits.

avoid any distortion by vertical and lateral collinearity. It was suggested that VIFs be lesser than 5 but a lenient criterion considered to be lesser than 10 (Hair *et al.*, 2014a; Kock, 2014). The assessment results of second-order constructs were depicted in Table 5.18 and Table 5.19, for CGL-Singapore and SLB-Malaysia, respectively. Meanwhile,

outer weight is the result of a multiple regression between the latent variable scores independent variables and the dependent variable as formative (Hair *et al.,* 2014a). It turns out to be an essential criterion while calculating the influence of a formative measurement.

Essentially, referred to Table 5.18 for CGL-Singapore, fortunately that all outer weights of formative variables were discovered significantly. In addition, there were no critical collinearity issues on these variables and all VIF outcomes for all formative variables were within the appropriate value which each of the VIF values less than 5.0. Subsequently, this study reflected all models of formative constructs has fulfilled the assessment benchmark, therefore the evaluation of the structural model was confirmed.

On the other hand, referred to Table 5.19 for SLB-Malaysia, fortunately that all outer weights of formative variables were discovered significantly. Meanwhile, all VIF outcomes for all formative variables were within the appropriate value except only ASS variable found with the collinearity issue as the VIF value is 5.341 wherein slightly greater than 5.0. This study reflected all models of formative constructs has fulfilled the assessment benchmark, thus the assessment of the structural model was confirmed.

5.5.3 Assessment of PLS-SEM structural model

The next level up in PLS-SEM analysis is to examine the inner model of the structural model after complete the quality analysis of the measurement model. The hypotheses coded as H1, H2, H3 and H4 could be tested by inspecting the structural model by giving an acceptable second-order constructs model and measurement model. In

addition, the structural model for the present study's research framework comprised of five constructs that are SQ, SVQ, IQ, SAT and IBS. After the PLS-SEM analysis with path weighting scheme algorithm, estimates were gained from the structural model relationship throughout path coefficients that characterised the hypothesised relationship amongst the constructs. The outcomes from the structural model, such as R Square (R^2), Effect Size (*f*2), Blindfolding and Predictive Relevance (Q^2) were discussed in the next subheadings.

5.5.3.1 Analysis of R square (R^2)

The R^2 measure is the main assessment benchmark of the structural model applying PLS-SEM. This measure to test the significance degree of the path coefficients (Hair *et al.*, 2014a). Despite the purpose of the explanatory-oriented PLS-SEM is to explain the variance of endogenous latent variable, the rationally high R^2 value should be gained. Basically, in marketing research studies, the R^2 value of 0.75, 0.50, or 0.25 for endogenous latent variables within the structural model should be translated as substantial, moderate or weak, individually. In concordance, the found R^2 value can be utilised to explain the quality of the structural model which deliberates the explanatory variance by the exogenous variables contained in the endogenous variable.

The assessment results depicted in Figure 5.4 for CGL-Singapore, it can be elaborated that, first of all, the R^2 value of the SAT was 0.891 where 89.1% variance was clarified by SQ, SVQ and IQ which deliberated as substantial. Secondly, the R^2 value was discovered about 0.556 for IBS, signifying that the SAT can represent about 55.6% of

the variance in the IBS, which was moderate level. It translates that 55.6% of the variance in the range of IBS can be justified by SAT.

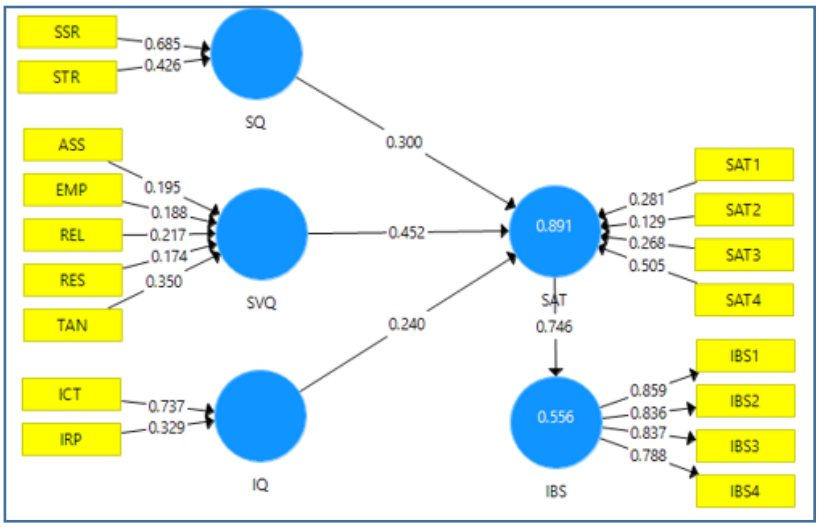

Figure 5.4
Assessment of the structural model for CGL-Singapore

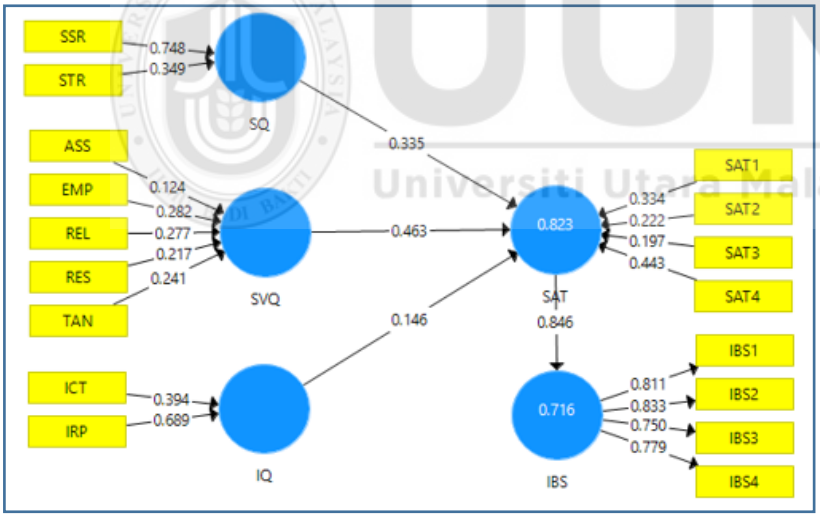

Figure 5.5
Assessment of the structural model for SLB-Malaysia

On the other hand, the assessment results depicted in Figure 5.5 for SLB-Malaysia, it can be elaborated that, first of all, the R^2 value of the SAT was 0.823 where 82.3% variance was clarified by SQ, SVQ and IQ which deliberated as substantial. Secondly, the R^2 value was discovered about 0.716 for IBS, signifying that the SAT can represent

about 71.6% of the variance in the IBS, which was moderate level. It translates that 71.6% of the variance in the range of IBS can be justified by SAT.

5.5.3.2 Analysis of effect size (*f*2)

As the harmonising to the R^2 results, it was suggested to calculate the *f*2 effect sizes of the particular latent variables influence on the dependent variables throughout the change in the R^2 value while a specific exogenous construct discarded in the model (Hair *et al.*, 2014a). Essentially, the *f*2 effect size was manually calculated utilising the formula: $f2 = (R^2 \text{ included} - R^2 \text{ excluded}) / (1 - R^2 \text{ included})$. Additionally, as suggested by Cohen (1988), the scale of *f*2 effect sizes that grounded on 0.02, 0.15 and 0.35 were utilised to translate small, medium and large effect sizes of the predictive variables, individually.

Table 5.24, for CGL-Singapore exhibits SQ, SVQ and IQ had differed effect size on the SAT. First of all, SQ has a small effect size of 0.138 on SAT. Whereas, IQ has a medium effect size of 0.156 on the SAT and SVQ also has a medium effect size of 0.257 on the SAT. This result had translated that the effect of SVQ and IQ more significant on SAT whereas SQ has a small effect on SAT. Last but not least, the testing on effect size *f*2 value from SAT to IBS was a large effect size of 1.252.

Table 5.25, for SLB-Malaysia exhibits SQ, SVQ and IQ had differed effect size on the SAT. Firstly, IQ has a very small effect size of 0.034 on SAT. SQ also has a very small effect size of 0.096 on the SAT. However, SVQ has a medium effect size of 0.175 on the SAT. This result had translated that the effect of SVQ more significant on SAT whereas

SQ and IQ has a very small effect on SAT. Lastly, the testing on effect size *f*2 value from SAT to IBS was a large effect size of 2.521.

Table 5.20
Effect size of latent constructs for CGL-Singapore

Endogeneous	Exogeneous	Included	Excluded	f^2	Effect size rating
SAT	SQ	0.891	0.876	0.138	Small
	SVQ	0.891	0.863	0.257	Medium
	IQ	0.891	0.874	0.156	Medium
IBS	SAT	0.556	0.000	1.252	Large

Note: IQ = Information Quality; SQ = System Quality; SVQ = Service Quality; SAT = User Satisfaction; IBS = Individual Benefits.

Table 5.21
Effect size of latent constructs for SLB-Malaysia

Endogeneous	Exogeneous	Included	Excluded	f^2	Effect size rating
SAT	SQ	0.823	0.806	0.096	Small
	SVQ	0.823	0.792	0.175	Medium
	IQ	0.823	0.817	0.034	Small
IBS	SAT	0.716	0.000	2.521	Large

Note: IQ = Information Quality; SQ = System Quality; SVQ = Service Quality; SAT = User Satisfaction; IBS = Individual Benefits.

5.5.3.3 Blindfolding and predictive relevance (Q^2) analysis

In complement to calculating the structural model quality by considering the R^2 values and effect sizes, additional assessment of the structural model is blindfolding. It comprises a process to produce the cross-validated communality and cross-validated redundancy. Referred to the suggestions from Hair *et al.* (2014a) and Hair *et al.* (2012), cross-validated redundancy is absolutely suitable to the PLS-SEM approach because it was evaluated by PLS-SEM estimates of the structural model and the measurement models to calculate eliminated data point. The Q^2 was computed to signify how good predictive relevance to the model (Hair *et al.*, 2014a). In accordance with Valerie (2012), Stone-Geisser's analysis was computed by the succeeding formula: $Q^2=1-$

SSE/SSO. In order to gain Q^2 throughout blindfolding technique, Hair *et al.* (2014a) suggested that the total of cases in the data should not be multiple integer numbers of the omission distance (*D)* or else the blindfolding process will be invalid. This concluded that the *D* value should be chosen range from 5 to 10. Subsequently, the present study utilised 9 as a value for *D* to gain cross-validated redundancy measures for each dependent variable. Moreover, Hair *et al.* (2014a) express that if the cross-redundancy value is above than zero, the model will have predictive quality; otherwise, the predictive relevance of the model cannot be established.

Table 5.22
Prediction relevance of the model for CGL-Singapore

Total	SSO	SSE	1-SSE/SSO
SAT	736.000	312.3990	0.5760
IBS	736.000	469.5730	0.3620

Note: SAT = User Satisfaction; IBS = Individual Benefits.

Table 5.23
Prediction relevance of the model for SLB-Malaysia

Total	SSO	SSE	1-SSE/SSO
SAT	720.000	335.8610	0.5340
IBS	720.000	401.9860	0.4420

Note: SAT = User Satisfaction; IBS = Individual Benefits.

Table 5.22 for CGL-Singapore depicts the value of cross-validated redundancy gained for SAT and IBS was found about 0.576 and 0.362, respectively. Therefore, these outcomes acknowledged that the model has suitable predictive relevance for the constructs. On the other hand, Table 5.23 for SLB-Malaysia depicts the value of cross-validated redundancy gained for SAT and IBS were found about 0.534 and 0.442, separately. As a consequence, these outcomes acknowledged that the model has suitable predictive relevance for the constructs.

5.6 Testing of hypotheses

The ultimate goal of the analysis was to test the hypotheses. The following hypotheses from H1 to H4 were analysed utilising SmartPLS 3.0 by benefiting the PLS-SEM algorithm and bootstrapping technique with 5,000 subsample iterations (Hair *et al.*, 2014a). Although path coefficients are very imperative in the PLS-SEM analysis, Hair *et al.* (2011) strengthened that when paths are non-significant or demonstrate signs that are opposite the hypothesised direction, the prior hypothesis should be rejected. Alternatively, significant paths indicating the hypothesised direction validate the proposed causal relationship empirically. The essential t-value for a two-tailed test is 1.96 with a significance level of 5% and 2.58 with a significance level of 1%. The analysis outcomes to be discussed in the next subheading comprises hypotheses testing that contains the path coefficient, bootstrapping and effect size results.

In this subheading, the testing of the direct effect hypotheses between latent constructs has been made throughout the PLS-SEM algorithm and bootstrapping of 5,000 subsamples iterations. The direct effect hypotheses defined as to predict the direct relationship between latent constructs as illustrated by an arrow. There are four direct effect hypotheses testing coded as H1, H2, H3 and H4. As for assessing the hypotheses, the path standardised estimate or beta (β), standard errors (S.E.), t-value and probability value were applied and showed in a parenthesis and the diagram (Hair *et al.*, 2014a).

Recommendations by Chin (2010), the β value of standardised paths should be about 0.20 or ideally the value has reached beyond 0.30 to be deliberated as meaningful. Despite the fact, Cohen (1988) classified standard path coefficients with absolute values

of lesser than 0.10 deliberated as a small effect, values of 0.30 as medium effect and values higher than 0.50 as large effect. With the aim to form hypothesis results more meaningful, R^2 value was embraced to identify to what range the variance in endogenous is justified by exogenous. Fundamentally, as recommended by Hair *et al.* (2014a), R^2 values of 0.75, 0.50 or 0.25 for endogenous latent variables be translated as substantial, moderate or weak, correspondingly. In the following headings, four direct effect hypotheses of the present study are discussed thoroughly.

5.6.1 H1a: There is a significant relationship between system quality and user satisfaction in CordLife Group Limited-Singapore.

For CGL-Singapore, the findings from the SmartPLS result indicating that this hypothesis H1a is accepted. The outcome demonstrated that the path coefficient from SQ to SAT was statistically significant with a strong standardised estimate and gained high t-value more than 5.117 ($\beta = 0.300$, S.E. = 0.059, $t = 5.117$, $p < 0.01$).

5.6.2 H1b: There is a significant relationship between system quality and user satisfaction in StemLife Berhad-Malaysia.

On the other hand, for SLB-Malaysia, the findings from the SmartPLS result indicating that this hypothesis H1b is accepted. The result demonstrated that the path coefficient from SQ to SAT was statistically significant with a strong standardised estimate and gained high t-value more than 4.473 ($\beta = 0.335$, S.E. = 0.075, $t = 4.473$, $p < 0.01$).

5.6.3 H2a: There is a significant relationship between service quality and user satisfaction in CordLife Group Limited-Singapore.

For CGL-Singapore, as for the direct hypothesis, H2a suggests a significant relationship between SVQ and SAT that generally supported by previous studies. In accordance, the relationship between these constructs was also established statistically significant (β = 0.4520, S.E. = 0.069, t = 6.531, $p < 0.01$) in HERP context.

5.6.4 H2b: There is a significant relationship between service quality and user satisfaction in StemLife Berhad-Malaysia.

On the other hand, for SLB-Malaysia, as for the direct hypothesis, H2b suggests a significant relationship between SVQ and SAT that generally supported by previous studies. In accordance, the relationship between these constructs was also established statistically significant (β = 0.4630, S.E.= 0.074, t = 6.245, $p < 0.01$) in HERP context.

5.6.5 H3a: There is a significant relationship between information quality and user satisfaction in CordLife Group Limited-Singapore.

For CGL-Singapore, the third hypothesis H3a, which demonstrated a significant relationship IQ and SAT were equally accepted. This was supported by the PLS algorithm and bootstrapping procedure which reveals IQ was statistically significant (β = 0.240, S.E. = 0.044, t = 5.400, $p < 0.01$) to SAT. The β value was huge and the $t > 2.58$ was greater than the threshold.

5.6.6 H3b: There is a significant relationship between information quality and user satisfaction in StemLife Berhad-Malaysia.

On the other hand, for SLB-Malaysia, the third hypothesis H3b, which demonstrated a significant relationship IQ and SAT were equally accepted. This was supported by the PLS algorithm and bootstrapping procedure which reveals IQ was statistically significant ($\beta = 0.146$, S.E. = 0.053, $t = 2.777$, $p < 0.01$) to SAT. The β value was huge and the $t > 2.58$ was greater than the threshold.

5.6.7 H4a: There is a significant relationship between user satisfaction and individual benefits in CordLife Group Limited-Singapore.

For CGL-Singapore, the fourth hypothesis H4a, that predicts a significant relationship amongst SAT and IBS was affirmed and accepted. The regression result produced by SmartPLS had demonstrated that there was a significant relationship amongst SAT and IBS ($\beta = 0.746$, S.E. = 0.035, $t = 21.009$, $p < 0.01$). The β value and the $t > 2.58$ were generally high.

5.6.8 H4b: There is a significant relationship between user satisfaction and individual benefits in StemLife Berhad-Malaysia.

On the other hand, for SLB-Malaysia, the fourth hypothesis H4b, that predicts a significant relationship amongst SAT and IBS was affirmed and accepted. The regression result produced by SmartPLS had demonstrated that there was a significant relationship amongst SAT and IBS ($\beta = 0.846$, S.E. = 0.020, $t = 41.768$, $p < 0.01$). The β value and the $t > 2.58$ were generally high.

5.6.9 Summary of hypotheses testing

All findings of direct hypotheses were established in preceding subheadings and reviewed in Table 5.24 and Table 5.25, for CGL-Singapore and SLB-Malaysia, respectively.

Table 5.24
Summary of hypotheses testing results for the direct effect for CGL-Singapore

Hypotheses	Path	Path Coefficient	S.E.	T-Value	Decision
H1a	SQ → SAT	0.300	0.059	5.117**	Accepted
H2a	SVQ → SAT	0.452	0.069	6.531**	Accepted
H3a	IQ → SAT	0.240	0.044	5.400**	Accepted
H4a	SAT → IBS	0.746	0.035	21.009**	Accepted

Note: *t-value > 1.96 ($p < 0.05$); **t-value > 2.58 ($p < 0.01$) IQ = Information Quality; SVQ = Service Quality; SQ = System Quality; SAT = User Satisfaction; IBS = Individual Benefits; S.E. = Standard Error.

Table 5.25
Summary of hypotheses testing results for the direct effect for SLB-Malaysia

Hypotheses	Path	Path Coefficient	S.E.	T-Value	Decision
H1b	SQ → SAT	0.335	0.075	4.473**	Accepted
H2b	SVQ → SAT	0.463	0.074	6.245**	Accepted
H3b	IQ → SAT	0.146	0.053	2.777**	Accepted
H4b	SAT → IBS	0.846	0.020	41.768**	Accepted

Note: *t-value > 1.96 ($p < 0.05$); **t-value > 2.58 ($p < 0.01$) IQ = Information Quality; SVQ = Service Quality; SQ = System Quality; SAT = User Satisfaction; IBS = Individual Benefits; S.E. = Standard Error.

5.7 Open-ended questions with answers analysis

In the questionnaire, there have three open-ended type questions were designed to get respondents feedback on the factors that promoting the HERP post-implementation success. Those three questions were raised within the Part III: Respondent comments and suggestions in the questionnaire.

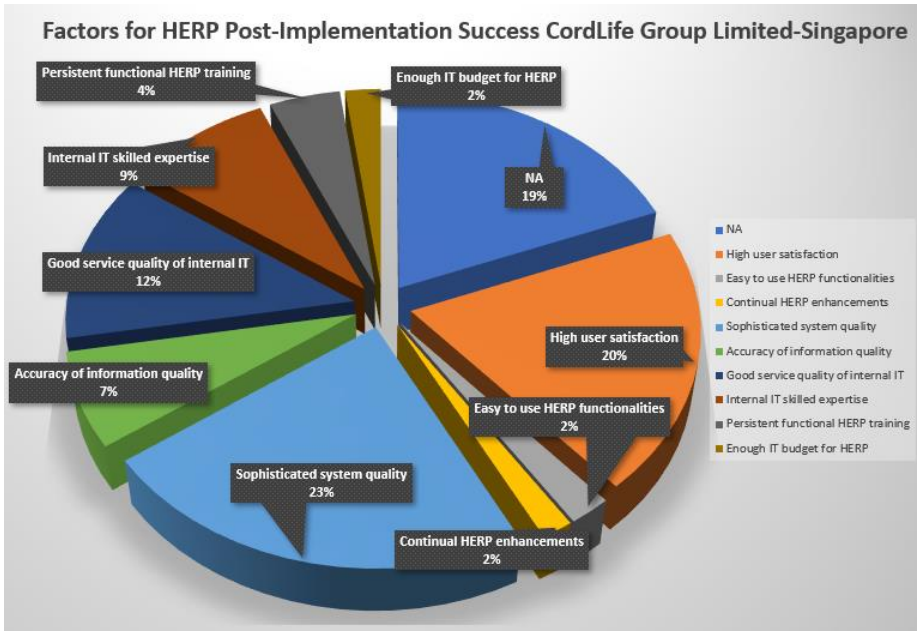

Figure 5.6
Answers for the open-ended questions for CGL-Singapore

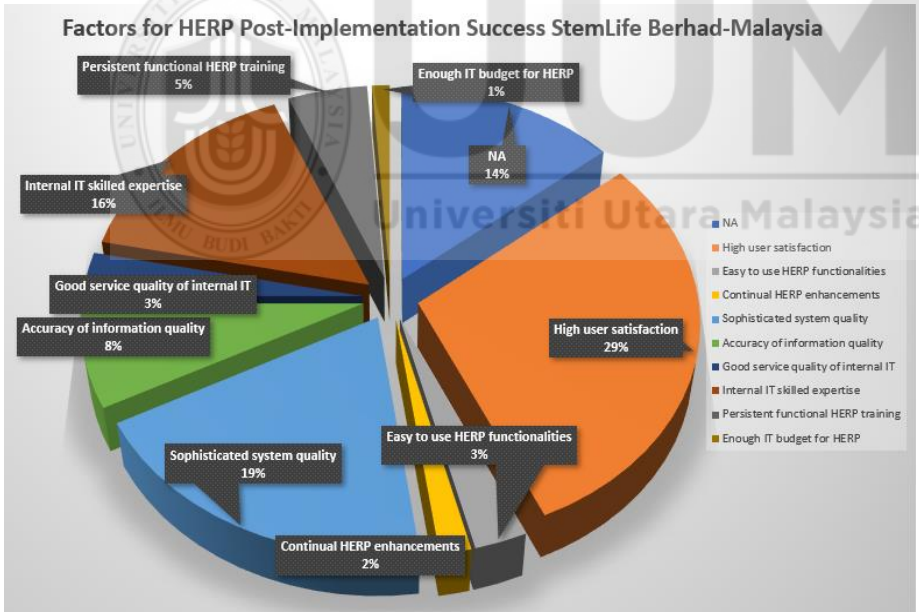

Figure 5.7
Answers for the open-ended questions for SLB-Malaysia

For CordLife Group Limited-Singapore, on factors promoting the HERP post-implementation success, the respondents indicated as shown in the Figure 5.6 below. 23% of the respondents indicated that HERP sophisticated system quality played a good

role in the HERP post-implementation success, 20% of the respondent said that high user satisfaction aided better productivity, 12% of respondents felt that good service quality of internal IT contributed to HERP post-implementation success. Those who indicated internal IT skilled expertise were 9%, accuracy of information quality was indicated by 7% and persistent functional HERP training was 4%. Three segments of 2%, respectively of the respondents indicated continual HERP enhancement, easy to use HERP functionalities and enough IT budget for HERP contributed towards HERP post-implementation success. Lastly, 19% of the respondents not provided any answer for the Part III: Respondent comments and suggestions wherein the open-ended type questions in the questionnaire.

On the other hand, for StemLife Berhad-Malaysia, on factors promoting the HERP post-implementation success, the respondents indicated as shown in the Figure 5.7 above. 29% of the respondents indicated that high user satisfaction played a good role in the HERP post-implementation success, 19% of the respondent said that sophisticated system quality aided better productivity, 16% of respondents felt that good internal IT skilled expertise contributed to HERP post-implementation success. Those who indicated accuracy of information quality were 8%, persistent functional HERP training was indicated by 5%, easy to use HERP functionalities and good service quality of internal IT were 3%, each respectively. 2% of the respondents indicated continual HERP enhancement and 1% of the respondents said enough IT budget for HERP contributed towards HERP post-implementation success. Lastly, 14% of the respondents not provided any answer for the Part III: Respondent comments and suggestions wherein the open-ended type questions in the questionnaire.

5.8 Chapter summary

This chapter provides an overview of the study's analysis and findings. It has presented findings on the response rate, profile of respondents and the statistical results. Generally, descriptive statistics reveal that the perception of respondents was at the moderate level for SQ, SVQ, IQ, SAT and IBS on the HERP in CordLife Group.

All constructs namely SQ, SVQ, IQ, SAT and IBS had a significant direct effect between them. In light of these results, the four hypotheses of this study have been accepted and outlined in Table 5.26 and Table 5.27, for CGL-Singapore and SLB-Malaysia, respectively.

Table 5.26
Summary of all hypotheses findings for CGL-Singapore

Hypotheses code	Hypothesis	Decision
H1a	There is a significant relationship between system quality and user satisfaction in CordLife Group Limited-Singapore.	Accepted
H2a	There is a significant relationship between service quality and user satisfaction in CordLife Group Limited-Singapore.	Accepted
H3a	There is a significant relationship between information quality and user satisfaction in CordLife Group Limited-Singapore.	Accepted
H4a	There is a significant relationship between user satisfaction and individual benefits in CordLife Group Limited-Singapore.	Accepted

Table 5.27
Summary of all hypotheses findings for SLB-Malaysia

Hypotheses code	Hypothesis	Decision
H1b	There is a significant relationship between system quality and user satisfaction in StemLife Berhad-Malaysia.	Accepted
H2b	There is a significant relationship between service quality and user satisfaction in StemLife Berhad-Malaysia.	Accepted
H3b	There is a significant relationship between information quality and user satisfaction in StemLife Berhad-Malaysia.	Accepted
H4b	There is a significant relationship between user satisfaction and individual benefits in StemLife Berhad-Malaysia.	Accepted

CHAPTER SIX

DISCUSSIONS AND CONCLUSIONS

6.1 Introduction

This is a final chapter of the study that summarising the study and key findings, discuss its implications to the managerial and theoretical prospect. It also exhibits the limitations of the study and recommendations for future research opportunities. At last, this chapter summarises and wraps up the study.

6.2 Recapitulation of the study

Chapter One discussed specifically the phenomenon and factors that contributed to the needs of an appropriate framework for HERP post-implementation success assessment with the support of significant references and statistics. This study tackled the problem that's associated with the HERP issues, particularly on how HERP was served in the healthcare industry. Based on complaints detailed in online media news, various factors had caused dissatisfaction from people, such as long waiting time, people congestion that was resulted from the low success rate of HERP post-implementation and so forth. Subsequently, it can be claimed that present HERP post-implementation success rate was still low to produce a greater level of satisfaction among users, which was deemed an elemental need for business performance, competitiveness and sustainability. In accordance, the model of the D&M ISSM (2003) which included the facet of human factors, such as SVQ, SAT and IBS evidences were found relevant to describe the role of in-house IS staff in serving HERP-based services. However, explaining the impact on the SAT throughout the SVQ alone was a too high expectation. The absence of quality

attributes and imbalance technological factors of HERP qualities, such as SQ and IQ has been recognised to be another influencing factor on the SAT.

Chapter Two was provided to present an overview of CordLife Group, since the HERP-based services considered something unfamiliar topic to public and non-practitioners. The chapter provided an overview of the HERP post-implementation phase in the Malaysian healthcare industry and explored in-depth about the HERP in Malaysian healthcare industry and CordLife Group exclusively.

Chapter Three with a comprehensive literature review on SQ, SVQ, IQ, SAT and IBS. The substance of literature reviews was rendered to support this study and several study gaps due to fragmented studies and lack of empirical studies for particular concepts and relationships were highlighted. The underpinning theory and the utilisation of the D&M ISSM (2003) model in the study's research framework was elaborated and discussed.

Chapter Four highlighted the research framework that theoretically developed from the D&M ISSM (2003) in relation to success elements that fragmented to human factors and technological factors. The SQ was measured formatively by two lower-order latent variables, SVQ was also measured formatively by five SERVQUAL dimensions, whereas IQ was measured formatively by two lower-order latent variables and SAT measured formatively four components but IBS was measured reflectively by another four components. In order to materialise research objectives, the hypotheses were divided into four hypotheses related to investigating the direct effect between SQ, SVQ, IQ, SAT and IBS. Given that two data set, namely CGL-Singapore and SLB-Malaysia,

therefore the four hypotheses multiplied into two. For example, H1, with H1a and H1b, for testing CGL-Singapore and SLB-Malaysia, respectively.

Chapter Five presented statistical analysis and findings that referred to the results of the tested hypotheses and the research objectives. This study trusted that all findings gained were able to furnish valuable contributions to the academic knowledge and IS practitioners in issues pertaining to the HERP. As to accomplish the test of these hypotheses of the study, SPSS version 22.0 and SmartPLS version 3.0 statistical software were utilised. The source of the analysis was grounded on 184 and 180 usable responses from CGL-Singapore and SLB-Malaysia, respectively. The multicollinearity, internal consistency reliability, indicator reliability, convergent validity and discriminant validity of the measurement model were fulfilled. Total response rate of 85% that collected from CordLife Group subsidiary companies. The results of the analysis revealed the four direct effect hypotheses on the relationships amongst SQ, SVQ, IQ, SAT and IBS were confirmed and accepted. The outline of the hypotheses result can be found in Table 5.26 and Table 5.27, for CGL-Singapore and SLB-Malaysia, respectively.

The summary of the hypothesized relationships and their empirical findings were highlighted in line with the three research questions associated with this study as follows:

1. What are the determinants that affect CordLife Group's HERP post-implementation success?

2. Can the success elements of the D&M ISSM be used as determinants that affect CordLife Group's HERP post-implementation success?
3. What are the differences between CordLife Group Limited-Singapore and StemLife Berhad-Malaysia on the determinants that affect CordLife Group's HERP post-implementation success?

In addressing the abovementioned research questions, this study hypothesized that there was a significant relationship between SQ and SAT; SVQ and SAT; IQ and SAT; SAT and IBS in CGL-Singapore and SLB-Malaysia, respectively. Subsequently, the four hypotheses coded as H1, H2 H3 and H4 were developed. The study's findings showed that all the hypotheses were supported for both dataset of CGL-Singapore and SLB-Malaysia, respectively. Therefore, the determinants that affected CordLife Group's HERP post-implementation were SQ, SVQ, IQ, SAT and IBS.

Secondly, the success elements that spelled-out in D&M ISSM model, namely SQ, SVQ, IQ, SAT and IBS were fully supported by the tested hypotheses result. Therefore, the answer for the second research question was clear that the success elements of the D&M ISSM can be used as determinants that affected CordLife Group's HERP post-implementation success.

Thirdly, the answer for third research question. there are no differences between CordLife Group Limited-Singapore and StemLife Berhad-Malaysia on the determinants that affect CordLife Group's HERP post-implementation success.

As expressed out in earlier chapters, there was a need to identify and comprehend the HERP success elements as highly important to IS practitioners. Subsequently, SAT to stimulate IBS with favourable responses from HERP users. Improper determination of HERP success elements for HERP post-implementation may cause the undesired output and jeopardise to the company's resources. Therefore, it was extremely important for IS practitioners, such as IS managers to identify the right success elements of HERP as this study ascertained the elements covered technology-oriented quality, namely SQ and IQ; human-oriented quality, such as SVQ performed by in-house IS staff with significant impact on SAT and IBS. Therefore, the first objective of this study aimed at identifying the determinants that affected CordLife Group's HERP post-implementation success. In pursuing the achievement of this objective, four hypotheses were developed and tested in relation to the determinants for HERP post-implementation success. The study found that success elements, including SQ, SVQ and IQ had significant relationship on SAT. SAT had significant relationship on IBS. Thus, the determinants that affected CordLife Group's HERP post-implementation success were SQ, SVQ, IQ, SAT and IBS.

Objective number two of this study aimed at integrating the D&M ISSM success elements as determinants for assessing CordLife Group's HERP post-implementation success. In pursuance of the second objective of this study, the same mentioned four hypotheses for the first objective were applied and tested. The result found a support for the integration between the D&M ISSM success elements as determinants for assessing CordLife Group's HERP post-implementation success. The present study had validated that SQ, SVQ and IQ that had a significant direct effect on SAT. In additional, SAT had significant relationship to IBS. Therefore, it was concluded that the D&M ISSM success

elements were fully integrated as determinants for assessing CordLife Group's HERP post-implementation success.

Lastly, the research objective number three to identify any differences between CordLife Group Limited-Singapore and StemLife Berhad-Malaysia on the determinants that affect CordLife Group's HERP post-implementation success. In pursuance of the third objective of this study, the same mentioned four hypotheses were applied and tested. The result found no differences between CordLife Group Limited-Singapore and StemLife Berhad-Malaysia on the determinants that affect CordLife Group's HERP post-implementation success.

6.3 Discussion of research objectives

The study theoretically developed and empirically tested a structural model on the relationships amongst SQ, SVQ, IQ, SAT and IBS. The perceptions and responses from the HERP users were the sources of data in assessing the research framework and hypotheses appeared in the study that later, leading to the accomplishment of the research objectives. The research findings revealed in the present study were discussed based on the research objectives and research questions that were developed from the problem statement. The following subheading offers a thorough discussion of the results of research objectives in relation to the study findings and existing literature reviews.

6.3.1 H1a: There is a significant relationship between system quality and user satisfaction in CordLife Group Limited-Singapore.

For the hypothesis coded as H1a, to investigate a significant relationship between SQ and SAT with respect to the HERP in CordLife Group Limited-Singapore. Hence, hypothesis one was developed to find the answers on these research objectives and tested using PLS-SEM path output regression. This study argued the importance of SQ to be operationalised as second-order constructs where two elements, namely SSR and STR should be performed simultaneously and measured formatively. The idea of SQ should be performed as a higher-order construct has been long established, but rarely adapted in past studies.

Another essential point, SAT in the present study was constructed from the formative of four components, namely satisfaction on SQ, SVQ, IQ and overall satisfaction to comprehend the complexity of human responses in HERP users' behaviour, which was also rarely adapted in past studies. Both constructs were validated systematically and contributed to meaningful findings.

For CGL-Singapore, the empirical finding recommended that there was a significant relationship among SQ and SAT. This highlighted the importance of SQ as one of the main contributory factors in simulating satisfactory response among users in the HERP-based services context.

6.3.2 H1b: There is a significant relationship between system quality and user satisfaction in StemLife Berhad-Malaysia.

On the other hand, for SLB-Malaysia, the hypothesis coded as H1b, to investigate a significant relationship between SQ and SAT with respect to the HERP in StemLife Berhad-Malaysia. Subsequently, for SLB-Malaysia, the empirical finding recommended that there was a significant relationship among SQ and SAT. This highlighted the importance of SQ as one of the main contributory factors in simulating satisfactory response among users in the HERP-based services context.

The significant result of the relationship between SQ and SAT was consistent with past studies, like high SQ of HERP leads to high SAT (Chen, Jubilado, Capistrano & Yen, 2015). It can be acknowledged that both SQ and SAT were equally important. Therefore, users were refusing to utilise the HERP when they experienced constant response delays, disconnections, deficiency of access or bad security (Shin, 2014). Both the D&M ISSM (2003) and prior research, for example, Chen, Jubilado, Capistrano and Yen (2015) argued a positive relationship among SQ and SAT and had examined by many past empirical studies. The in-depth explanation of this finding, the elements of SQ namely SSR and STR were demonstrated significant part in forming SQ that created a significant relationship to SAT. This finding indicated that CordLife Group's HERP users were conservative where they preferred the HERP was easy to use, learn, process data accurately and meeting their job requirements. They also preferred HERP graphical user interface should be certainly adjusted to their personalised approach or needs. Moving forward, the IS practitioners should review back their management and operational strategies toward the improvement of SSR and STR elements.

6.3.3 H2a: There is a significant relationship between service quality and user satisfaction in CordLife Group Limited-Singapore.

For the hypothesis coded as H2a, to investigate a significant relationship between SVQ and SAT with respect to the HERP in CordLife Group Limited-Singapore. Henceforth, the second hypothesis that apprehended this relationship was tested using PLS-SEM path coefficient analysis and subsequently, the hypothesis was accepted based on the statistical result.

For CGL-Singapore, the outcome of the analysis, as expected, revealed that SVQ had influenced significantly to SAT. This study demonstrated results which corroborated the findings of several other recent years studies, such as an extensive attention in the service literature has been given to the connection between SVQ and SAT (Izogo & Ogba, 2015; Rajaratnam *et al*., 2014). Therefore, SVQ played a crucial role to attain competitive advantage lied in delivering high SVQ that able to effect in SAT (Meidutė-Kavaliauskienė, Aranskis & Litvinenko, 2014). Furthermore, several studies have presented consistent evidence on the direct and positive relationships between SVQ and SAT, such as studies carried out by Han and Hyun (2015), Kashif, Shukran, Rehman and Sarifuddin (2015) and Rajaratnam *et al*. (2014). This may explain why the HERP users demanded outstanding quality features be incorporated in SVQ provided by the in-house IS staff. Performance of SVQ determined the level of satisfaction, for instance, excellent quality will increase SAT but when poor quality demonstrated, the HERP users will be dissatisfied.

6.3.4 H2b: There is a significant relationship between service quality and user satisfaction in StemLife Berhad-Malaysia.

On the other hand, for SLB-Malaysia, the hypothesis coded as H2b, to investigate a significant relationship between SVQ and SAT with respect to the HERP in StemLife Berhad-Malaysia. Henceforth, the second hypothesis that apprehended this relationship was tested using PLS-SEM path coefficient analysis and subsequently, the hypothesis was accepted based on the statistical result.

For SLB-Malaysia, the outcome of the analysis revealed that SVQ had influenced significantly to SAT. This highlighted the importance of SVQ as one of the main contributory factors in simulating satisfactory response among users in the HERP-based services context.

6.3.5 H3a: There is a significant relationship between information quality and user satisfaction in CordLife Group Limited-Singapore.

For the hypothesis coded as H3a, to examine a significant relationship between IQ and SAT with regard to the HERP in CordLife Group Limited-Singapore. Working to materialise the research objectives, the third hypothesis was uttered to predict a significant influence on the relationship between IQ and SAT and tested using PLS-SEM regression.

For CGL-Singapore, the empirical finding recommended that there was a significant relationship among IQ and SAT. This highlighted the importance of IQ as one of the main contributory factors in simulating satisfactory response among users in the HERP-

based services context. Several studies, such as Wang and Lai (2014) determined that one of the essential factors that influence SAT is IQ. High quality of information leads to SAT (Chen, Jubilado, Capistrano & Yen, 2015). Numerous investigations discovered that IQ had a positive significant relationship with SAT (Ghasemaghaei & Hassanein, 2015). Furthermore, Wang and Lai (2014) revealed that IQ has a positive effect on SAT in their quantitative study which questioned 295 employees and the findings supported by Cho *et al*. (2015). One way to interpret this finding is that the higher levels of information value incorporated into the HERP-based service, the more likely it is to have a favourable SAT on the HERP-based services. The concept of IQ is broad that covered assessment on the perception of information utilisation in respect of what is received or given. A better understanding of what and how information value will be evaluated by users was essential. IQ was a part of the cognitive process where the users will do the evaluation and rationale of their benefits before any responses, such as satisfaction existed (Ghasemaghaei & Hassanein, 2015). The positive perception of IQ was vital for producing SAT in achieving successful HERP-based services and this was being increasingly recognised by the IS practitioners and the academic community as well.

6.3.6 H3b: There is a significant relationship between information quality and user satisfaction in StemLife Berhad-Malaysia.

On the other hand, for SLB-Malaysia, the hypothesis coded as H3b, to examine a significant relationship between IQ and SAT with regard to the HERP in StemLife Berhad-Malaysia. Working to materialise the research objectives, the third hypothesis

was uttered to predict a significant influence on the relationship between IQ and SAT and tested using PLS-SEM regression.

For SLB-Malaysia, the empirical finding recommended that there was a significant relationship among IQ and SAT. This highlighted the importance of IQ as one of the main contributory factors in simulating satisfactory response among users in the HERP-based services context. An addition to the finding, two dimensions, namely ICT and IRP applied in framing IQ that made a significant influence on the SAT. In regard to the context value for quality and performance, it was highlighted in users' response that they were favoured to the consistency of quality performance and well-made of HERP-based services. Other components in IQ preferable by the HERP users were the information representation in the comfortable manners that gave the positive impression toward HERP users (Chen, Jubilado, Capistrano & Yen, 2015). The HERP must be designed with informative-oriented service as part of HERP-based service, for example, provided the suitable reports to each departmental user in facilitating their operational work with higher productivity and efficiency (Chen, Jubilado, Capistrano & Yen, 2015).

6.3.7 H4a: There is a significant relationship between user satisfaction and individual benefits in CordLife Group Limited-Singapore.

For the hypothesis coded as H4a, to scrutinise a significant relationship between SAT and IBS with regard to the HERP in CordLife Group Limited-Singapore. As accomplishing the research objectives, the fourth hypothesis was articulated to predict a significant impact on the relationship between SAT and IBS and tested utilising PLS-SEM regression.

For CGL-Singapore, the empirical finding recommended that there was a significant relationship among SAT and IBS. This highlighted the importance of SAT as one of the main contributory factors in simulating individual benefits among users in the HERP-based services context. Several studies, such as an evidence in the IS literature indicated that satisfied HERP users were more likely to be productive exceptionally where the use of such HERP was mandatory (Hsu *et al*., 2015). One manner to translate this finding was the greater levels of SAT elements assimilated into the HERP-based service, the more likely to have a positive IBS on the HERP-based services. The concept of IBS was large that included evaluation of perception on service usage in regard of what was obtained and what was given and it also included staff efficiency and effectiveness facet. A better consideration of what and how SAT will be assessed by the users was imperative. IBS was a part of the cognitive process where the users will do the rationale of their usage and benefits before any responses, such as satisfaction happened (Hsu *et al*., 2015). The positive perception of the SAT was crucial for generating IBS in realising successful HERP-based services and this was being progressively acknowledged by the IS practitioners and academic society as well. In addition to the finding, four dimensions, namely SAT1, SAT2, SAT3 and SAT4 for SAT that made statistically significant stimulus to IBS. In regard to the SAT, it was emphasised in users' response that they were supported to coherent of quality performance and well-made of the HERP.

6.3.8 H4b: There is a significant relationship between user satisfaction and individual benefits in StemLife Berhad-Malaysia.

On the other hand, for SLB-Malaysia, the hypothesis coded as H4b, to scrutinise a significant relationship between SAT and IBS with regard to the HERP in StemLife Berhad-Malaysia. As accomplishing the research objectives, the fourth hypothesis was articulated to predict a significant impact on the relationship between SAT and IBS and tested utilising PLS-SEM regression.

For SLB-Malaysia, the empirical finding recommended that there was a significant relationship among SAT and IBS. This highlighted the importance of SAT as one of the main contributory factors in simulating individual benefits among users in the HERP-based services context.

6.3.9 The study's empirical framework

In conclusion, as to respond to the present research objectives, the HERP success elements were identified and ascertained that should be embraced by IS practitioners. Subsequently, the SAT can stimulate IBS with favourable responses from HERP users. The study's framework that was tested empirically is depicted in Figure 6.1.

Firstly, this study managed to identify and ascertain the elements covered technology-oriented qualities, namely SQ and IQ; human-oriented quality, such as SVQ performed by in-house IS staff with significant impact on SAT and IBS. Secondly, the present study had validated that SQ, SVQ and IQ had the significant direct effect on SAT. Thus, it was concluded that the D&M ISSM success elements were fully integrated as

determinants for assessing CordLife Group's HERP post-implementation success. Thirdly, there are no differences between CordLife Group Limited-Singapore and StemLife Berhad-Malaysia on the determinants that affect CordLife Group's HERP post-implementation success.

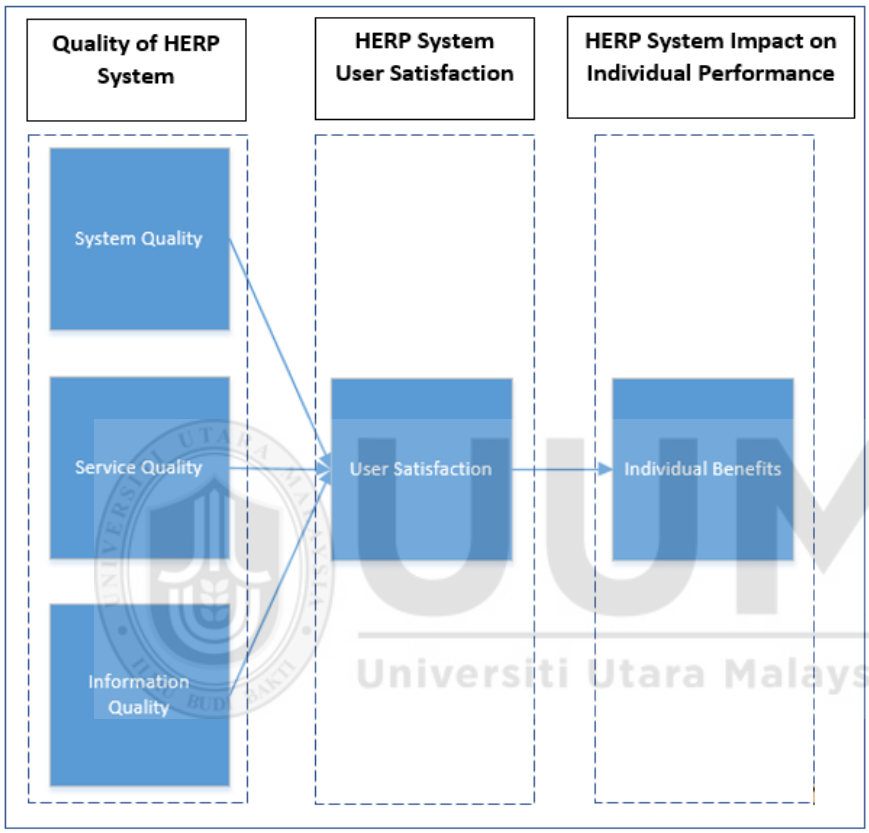

Figure 6.1
The study's empirical framework

6.4 Implications of the study

Present study unfolds the interpretation of HERP users' behavioural studies in term of satisfaction on the HERP-based services especially in the healthcare industry. As pointed out in Chapter One, healthcare sector plays paramount contributor to the country's economy, specifically in Malaysia and Singapore, therefore HERP-based services become so important to commercial activities and organisation's business

performance. In concise, the role of HERP-based services considered more than basic services performed by the IS department. Therefore, it is imperative to fulfil the requirements and expectations of HERP users. This study is an early effort in investigating the satisfaction of HERP users in the healthcare industry, including their contributing success elements, such as technological factors and human factors for the HERP post-implementation success assessment. The implication of this study in terms of practical and theoretical viewpoints was deliberated in the succeeding subheading.

6.4.1 Managerial and practical implications

This subheading features various managerial and practical implications translated from the study's findings. Firstly, mixes of five elements of SVQ performs a vital role in determining the perception of SVQ that delivered by in-house IS staff. While creating a high value perception in HERP-based services, the result designates that several elements of SVQ have emerged as the key instrument to SVQ in producing a satisfaction worthiness feeling in service consumption. Subsequently, the five elements of SVQ namely TAN, REL, RES, ASS and EMP, have demonstrated a critical role in producing satisfaction among HERP users. Therefore, it demands the IS managers recognise deeply on the healthcare industry features preferred by their users and choose the right SVQ to be incorporated in their service operations toward reaching high service performance that gives extra mileage to business competitiveness and sustainability.

SVQ of IS staff is important to ensure the success of the implemented HERP because it directly influences employees' total satisfaction. The past exceptional studies conceived SVQ affecting on the SAT for the system in the setting of Web-based services. Such an

argument is justifiable due to services are normally delivered by information technologies in the Web-based setting, causing IQ and SQ the pre-requisites for delivering quality services. However, this may not justifiably relate to the case of utilising the HERP in some extends. For instance, employees frequently accept offline human-based services from the in-house IS staff for using the HERP, rather than via technologies. Even if they communicate with IS staff throughout IT-based interfaces, the HERP is not the technology utilised by employees for interaction. Furthermore, employees may communicate with IS staff on occasions not associated with the HERP.

Essentially, the assessment on HERP-based services are rational functions of the service delivered by the in-house IS staff's namely SVQ. Despite that SVQ has been incorporated to the updated D&M ISSM since 2003, most HERP studies failing to deliberate that fulfilling the hedonic needs of HERP users with human-delivered service could stimulate satisfaction of the HERP. This suggests that managers should carefully scrutinise SVQ of in-house IS staff, not limited to the delivery of HERP-based services yet also in their routine service interactions with HERP users. In order to support employees benefiting from the HERP's functionality, managers should constantly develop IS staff's capability, competence and know-how in the HERP applications. Hence, they can deliver updated technical support and on-site training that needed by HERP users. The findings also emphasise the necessity to management determinations in developing an interpersonal-oriented IS service staff that can deliver pleasurable service and experiences for the HERP users.

Furthermore, in-house IS staff should embrace user-friendly measures in order to evaluate primary information about the needs of the HERP users. Assessment by HERP users about service performance and how their satisfaction is uttered become the essential elements to the development of effective delivery of HERP-based services. The findings of this study demonstrated that satisfaction was inspired mainly by cognitive component in term of service compared with other and followed by overall satisfaction assessment. In accordance, adapting quality management systems, such as ISO9001 or total quality management is one of the ways to facilitate HERP-based services in performing better and more sustainable as the present in-house IS staff are lacking in this aspect.

Secondly. apart from offering services with traits of quality and value, technology-oriented services, namely SQ and IQ of the implemented HERP is imperative. Hence, user acceptance of quality and value cannot be disconnected while using the HERP-based services. Consequently, quality and value facets are important to encourage satisfaction responses. The result of this study also had recognised the essential role of technological quality dimensions of HERP-based services impact on the SAT. It was translated that managers are required to uphold best practices, such as preventive and corrective systems in HERP-based services as the users expect no HERP interruption when they are going to use the HERP to facilitate their operational work conveniently. This is their primary objective in consuming the HERP-based services and maximum satisfaction among HERP users can be gained if this objective is preserved.

Thirdly, the findings recommend that IS managers should be particularly thoughtful in choosing the right metrics for scrutinising employees' satisfaction of the implemented HERP. In addition, more management strategy should be focused toward uplifting employees' satisfaction on the HERP's installed functionalities and applications. For instance, HERP-related interventions that involve the software and work process training, always stabilise at a particular point of being just sufficient for employees to deliver their work tasks and administrative activities, which are not considered to further inspire advance exploration of HERP functionality. Therefore, for favourable outcomes, IS managers are encouraged to formulate interventions that uplifting employees' learning efforts. This is due to satisfaction contributes to each individual employees' benefits of utilising the HERP. In addition, satisfaction is the fundamental to successful HERP usage in the long run. Essentially, the SAT is seen as a consequence of receiving service, particularly SQ, SVQ and IQ. Therefore, managing SAT as important as past studies had acclaimed SAT still functioning as a central tendency of marketing strategies and management guidelines that lead to business success, high service performance, profitability and competitive advantage (Akamavi *et al.,* 2015; Ameer, 2014; Kitapci *et al.,* 2014; Wu, 2014; Yeung *et al.,* 2013).

Therefore, in governing SAT, the managers are advised to measure regularly and identify which features and benefits in service that priority for their HERP users. As satisfaction is one of outcome from service consumptions, the managers are required to identify important aspects from the beginning stage to the end of service consumptions and track HERP users' responses systematically. It enables managers to concentrate on the most important predictors of performance while providing inputs in designing

HERP-based service architecture that effectively adapts to user requirements. Furthermore, the proposed success elements based on the D&M ISSM (2003) fully supported with the respondents' feedback in the questionnaire, Part II: Respondent Comments and Suggestions on the criterion of a successful HERP. In addition, the findings have shown the in-house IS staff should be made known visibly on organisation inspiration in serving their users by establishing effective communication flow, cultivating excellent HERP-based service culture and provide knowledge on HERP product through periodical internal meeting and training programmes.

Fourthly, this study building on the D&M ISSM (2003), proposed and tested the model that illuminates how SQ, SVQ and IQ, directly influence HERP post-implementation success from users' perspectives on SAT and IBS. The results of the present study present critical research implications for the evaluation of a successful HERP at its post-implementation phase. Essentially, the findings translate that while users require useful system and information quality to fulfil their practical needs, their affective manner of satisfaction concerning the HERP is strongly determined by human-delivered services from in-house IS staff. The research findings ascertain that SQ, SVQ and IQ can directly influence the success of the HERP at the post-implementation phase, eventually, improves employees' SAT and IBS, accordingly. The study's research framework can be translated into a practical framework that can be utilised by managers who intend to comprehend the operational and strategic effectiveness of the implemented HERP through increasing employees' SAT and IBS.

Fifthly, the implication of this study is not limited to practitioners only, but the outcomes of this study also can be referred by the related ministries or agencies of the Malaysian government, such as Ministry of Health and other healthcare organisations. The Malaysian government stresses on the improvement of IS, such as HERP in public hospitals or healthcare organisations. One of the enlisted initiatives is to enhance HERP-based services and management by reviewing HERP post-implementation success implementation. In addition, the low rate of successful implementation of HERP in Malaysian healthcare industry for a more competitive rate and the reinforcement of a practical framework for securing the post-implementation HERP. Hence, the findings of the present study provide detailed information concerning to which components need to be concentrated in order to enrich HERP users' perception of the quality of the HERP-based services that reach the maximum level of satisfaction. It was recommended to execute the grading scheme for HERP that reflects the user work productivity and efficiency after use HERP. For example, the implemented HERP must conform to a high HERP quality specification in order to facilitate individual user work productivity and efficiency. In contrast, the HERP with basic quality specification will foresee to produce low productivity and efficiency of the employee during their operational work.

Last but not least, the healthcare organisations can capitalise on the findings of this study for their practical framework that serve as guidelines in upholding HERP-based services and the related operational work. The contribution of this study can help the respective department to improve the management skills of HERP-based services. By having the systematic and practical guidelines in HERP related operational work; the practitioners, particularly the IS managers and professionals would have prospects to acquire and

practice the right manner in supporting the implemented HERP-based services in the Malaysian healthcare industry.

6.4.2 Theoretical implications

The foundation of research framework was based on the D&M ISSM (2003) model that views the collection of human factors and technological factors in forming the success elements of HERP post-implementation success assessment in the healthcare industry. It also postulates that human factors as SVQ, SAT and IBS interact with technological factors, such as SQ and IQ for assessment that drives HERP users' response, such as a satisfaction to represent an internal response. Accordingly, four hypotheses were formulated from the present study's research framework that offers the essential empirical evidence as a part of contributing to the current academic knowledge.

Firstly, this study makes contributions to the IS literature by establishing the relationships between each success element of the D&M ISSM (2003) model in the healthcare industry by specialising in a case example of CordLife Group. On the contrary, the findings were found against the concept of the D&M ISSM (2003) model as recommended by Hsu *et al.* (2015) but in line with the original of the D&M ISSM (2003) model proposed by D&M (2003). On the basis of this model, it may explain the reason why the highlighted success elements can still influence significantly in response to the SAT.

Secondly, in further findings, the SVQ model proposed by Parasuraman (1998) was found suitable to represent SVQ elements contain in service specifically in HERP-based

services. The present finding also found that all elements of SQ, SVQ and IQ were coordinated well through reflective approach at lower-order latent variable and acted meaningfully to form SQ, SVQ and IQ as second-order constructs using the formative approach, respectively. This reflective-formative approach to assess and conceptualise SQ, SVQ and IQ as a higher-order is one of the primary studies ever conducted.

Thirdly, it was contended that the application of SERVQUAL with five dimensions is the enough adequacy of quality assessment services. Lastly, the relationships diagrammatically illustrated in the research framework that consists of SQ, SVQ, IQ, SAT and IBS had rarely tested in the HERP setting specifically in the healthcare industry. The information and findings contained in the present study provide a new contribution to the academic knowledge by adding one more research input pertaining to individual user behaviour in the service context.

6.5 Limitations of the study

Despite the outcomes from the present study have shed light on numerous critical issues, yet the study's limitations to a certain extent should be deliberated when interpreting the results. On the other hand, these limitations offer some opportunities for future studies to consider in order gaining further knowledge.

Firstly, this study focuses on SAT to represent the internal response of the individual user as the outcome of the behaviour. Of course, SAT is not the end of the business objective. Numerous past studies had verified that the SAT is one of the antecedents of the other outcome, such as IBS in the present study. However, that overlooked the

satisfaction of the organisation's valued customers. Thus, this study outcome was limited to internal response only.

The second limitation is that this study had focused on the direct relationships only. There are few other moderating variables that could possibly influence SAT, such as respondent demographic, experience and the type of HERP users like transactional users versus management users.

Thirdly, this study faced difficulties in finding enough empirical studies in the context of HERP-based services that involves variables used in the study. Moreover, past studies gave less attention to the relationships between SVQ to other technological factors, such as SQ and IQ. In addition, the moderating effect of SVQ between SQ and IQ with SAT, separately causes limited empirical evidence to support the findings of the study. Future research to investigate the moderating effects that based on the study's research framework would beneficial to the academic.

Last but not least, the limitation was related to respondents. The respondents in this study were among CordLife Group's HERP users. Although it was stated that both CGL-Singapore and SLB-Malaysia are the neighbouring country that the most advanced and rapid growth of economic activities countries in the region, it may not be representative of all CordLife Group as a whole in CordLife Group.

6.6 Recommendations for future research

This study offers opportunities for future research where the findings and limitations of the study become a basis of the recommendations. Future research may explore more comprehensively in several areas as discussed in this subheading.

Firstly, adding more constructs, such as Use, Intention to Use and other success elements from the other ISSM model would give extra academic mileages due to the complexity of HERP that may vary according to diverse influence factors. Equally important, although the result of explaining variance in SAT resulted from SQ, SVQ and IQ were 85.9%, considerably high, another 14.1% could be explained by other possible variables that influence SAT. Future studies should consider what other potential factors that can influence SAT as well as IBS.

Secondly, although this study has been developed based on the D&M ISSM (2003) model in the healthcare industry that used SAT as intermediary variables, there are still unknown in HERP setting, whether the presence of mediating variables could influence the D&M ISSM (2003) model. For this reason, it is recommended that future research should investigate the mediating influence, such as HERP users' age, gender and other demographic elements in the present study's model.

Thirdly, past studies always focused on individual components of endogenous variables create a highly complex model and sometimes bring confusion interpreting the variable concept. Therefore, using low-order and high-order measurement as applied in this study makes the research model simpler and support the concept of variables. Application of

formative assessment at a higher-order level able to generate high impact on endogenous variables and statistical power of each indicator that form the higher-order construct can be identified. However, the concept of low-order and high-order constructs or hierarchical order constructs in past studies were not commonly applied. Hence, it is strongly advised that future research to apply low-order and high-order constructs and formative assessment that commensurate with the proposed concept.

Fourthly, as indicated in the study's limitations heading, even though the concept of SVQ has been made known since 1988, there are fragmented and limited studies to investigate the role of SVQ as a whole that linked to other constructs, such as SQ, IQ and SAT. Additionally, this study also found that there is a lack of studies to investigate the moderating role of SVQ between SQ and IQ with SAT, separately. In this manner, it would bring benefits to the academic knowledge when the said relationships are further investigated in future studies.

Last of all, it is implied that the selected research sample size could be bigger in future studies for a more comprehensive result of the way of taking samples from diverse geographical areas across multiple regional countries that may include the diversity of cultures and social structures. It is also recommended that the type of respondents should be expanded to another category of HERP users, such as transactional users versus management users for a generalisation of the study outcome. Moreover, the respondents in the present study were selected among CordLife Group. Therefore, reproducing and expanding this study to other regions and countries and other services would examine the applicability of the present findings. Additionally, it would deliver a basic

foundation for further review or validation of the research framework that formulated in the present study to comprehend the variations of the HERP users' behaviour.

6.7 Conclusion

First and foremost, the main outcome of the study is the empirical framework for assessing HERP post-implementation success assessment in the healthcare industry by specialising in a case example of CordLife Group. The descriptive result of this study recommended that the level of satisfaction among HERP users of HERP-based services still at the moderate level. This meant that the perception of HERP users on SQ, SVQ, IQ, SAT and IBS value at the medium level. The structural assessment of the research framework signified that the model had an adequate prediction relevance for the constructs throughout blindfolding procedure in PLS-SEM method. Briefly, the study's results revealed that for the direct effect, the relationships between SQ, SVQ, IQ, SAT and IBS were found significant with reasonably high statistical results. Essentially, the SAT was effectively influenced by the predictors of SQ, SVQ and IQ.

In summary, four hypotheses formulated from research framework were found accepted. Thus, the research objectives of the study were accomplished. In addition, the findings of the present study were discussed and suggested the managers to incorporate workable strategies in HERP-based services in terms of SQ, SVQ and IQ in order to grant positive responses of satisfaction among HERP users. Periodically assessment of users' feedback on services may aid in-house IS staff to improve their HERP-based services and able to track any changes in behaviour trends that act as input for further enhancement of HERP-based services.

Several limitations of the study were recognised which offers opportunities for future research. It was suggested that future studies include Use, Intention to Use and other antecedent factor and moderator variable in the study model. Further validation of the study's findings was encouraged by expanding the sample size, type of healthcare, geographical area and other business sectors.

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APPENDICES

APPENDIX A

Measurement of user satisfaction used in recent studies

No.	Authors	Year	Industry	Approach	Item(s)	Scales	Components
1	Albayrak & Caber	2015	Hotel	Transaction	1	1:strongly disagree, 5:strongly agree	General satisfaction
2	Han & Hyun	2015	Medical Tourism	Cumulative	3	1:extremely disagree,7:extremely agree	General satisfaction, affective and cognitive
3	Akamavi *et al*.	2015	Airlines	Transaction	4	1:strongly disagree, 5:strongly agree	Cognitive and affect-based
4	Eid & El-gohary	2015	Tourism	Transaction	4	1:strongly disagree, 5:strongly agree	Emotion, performance, cognitive
5	Noyan & Simsek	2014	Shopping	Transaction	7	1:extremely disagree,7:extremely agree	General satisfaction, affective, value, disconfirmation, cognitive and need fulfilment
6	Hassan, Jusoh & Hamid	2014	Insurance	Cumulative	5	1:strongly disagree, 5:strongly agree	General satisfaction, affective, disconfirmation and cognitive
7	Eisingerish *et al*.	2014	Financial Services	Cumulative	3	1:strongly disagree, 5:strongly agree	General satisfaction, affective and cognitive
8	Loureiro *et al*.	2014	Shopping	Transaction	3	1:strongly disagree, 5:strongly agree	Cognitive and affect-based
9	Giovanis *et al.*	2014	Telecommunication	Transaction	3	1:strongly disagree, 5:strongly agree	Emotion
10	Suki	2014	Airlines	Transaction	3	1:strongly disagree, 5:strongly agree	Emotion, performance, cognitive
11	Wu	2014	Casino	Transaction	3	1:extremely disagree,7:extremely agree	General satisfaction, affective and cognitive
12	Ali	2014	Hotel	Transaction	4	1:strongly disagree, 5:strongly agree	Cognitive and affect-based
13	Koufteros *et al*.	2014	Web purchase	Cumulative	8	1:extremely disagree,7:extremely agree	General satisfaction, affective, disconfirmation, cognitive and need fulfilment
14	Koufteros *et al*.	2014	Web purchase	Transaction	9	1:extremely disagree,7:extremely agree	General satisfaction, affective, disconfirmation, cognitive and need fulfilment
15	Terpastra & Verbeeten	2014	Financial Services	Cumulative	9	1:totally disagree, 4:totally agree	General satisfaction, affective, disconfirmation, cognitive and need fulfilment

APPENDIX B

The summary of original measurement scales and reliability results. Reliability of reflective constructs

No.	Variable	Measurement items	Reliability	Number of items	Original Scales	Source
1	**System quality** *System-related*	SSR1 SSR2 SSR3 SSR4	0.789 0.716 0.659 0.819	4	1 = strongly disagree and 5 = strongly agree	Hsu *et al*. (2015) Gable *et al*. (2008)
2	**System quality** *Task-related*	STR1 STR2 STR3 STR4	0.798 0.806 0.800 0.690	4		Nelson *et al*. (2005)
3	**Information quality** *Context*	ICT1 ICT2 ICT3	0.814 0.812 0.782	3		
4	**Information quality** *Representation*	IRP1 IRP2	0.910 0.920	2		
5	**Service quality** *Tangibility*	TAN1 TAN2 TAN3 TAN4	0.746 0.848 0.644 0.758	4	1 = strongly disagree and 5 = strongly agree	Hsu *et al*. (2015) Parasuraman *et al*. (1988)
6	**Service quality** *Reliability*	REL1 REL2 REL3 REL4 REL5	0.895 0.875 0.904 0.860 0.844	5		Pitt *et al.* (1995)
7	**Service quality** *Responsiveness*	RES1 RES2 RES3	0.891 0.899 0.905	3		
8	**Service quality** *Assurance*	ASS1 ASS2 ASS4 ASS5	0.948 0.941 0.866 0.926	4		
9	**Service quality** *Empathy*	EMP1 EMP2 EMP3 EMP4	0.880 0.882 0.897 0.911	4		

APPENDIX B (Continued)

The summary of original measurement scales and reliability results. Reliability of reflective constructs

No.	Variable	Measurement items	Reliability	Number of items	Original Scales	Source
1	**Individual Benefits**	IBS1 IBS2 IBS3 IBS4	0.857 0.919 0.927 0.940	4	1 = strongly disagree and 5 = strongly agree	Hsu *et al*. (2015) Alhibly (2011) Tansley *et al*. (2001)

Validity of the first-order formative constructs

No.	First-Order Formative Constructs	Measurement Items	Weight	VIF	Number of items	Original Scales	Source
1	**User satisfaction**	SAT1 SAT2 SAT3 SAT4	0.441 0.302 0.178 0.244	1.023 2.208 1.000 2.209	4	1 = strongly disagree and 5 = strongly agree	Hsu *et al*. (2015) Wixom and Todd (2005) Sedera and Tan (2005)
2	**Individual Benefits**	IBS1 IBS2 IBS3 IBS4	0.217 0.294 0.323 0.309	2.085 1.132 1.089 1.057	4	1 = strongly disagree and 5 = strongly agree	Hsu *et al*. (2015) Gable *et al*. (2008)

Validity of second-order formative constructs

No.	Second Oder Constructs	First-Order Constructs	Weight	VIF	Original Scales	Source
1	**System Quality**	Task-Related System-Related	0.517 0.596	1.534 1.534	1 = strongly disagree and 5 = strongly agree	Hsu *et al*. (2015) Gable *et al*. (2008) Nelson *et al*. (2005)
2	**Information Quality**	Context Representation	0.603 0.509	1.504 1.504		
3	**Service Quality**	Tangibility Reliability Responsiveness Assurance Empathy	0.137 0.252 0.195 0.271 0.267	3.126 3.286 3.077 3.315 1.427	1 = strongly disagree and 5 = strongly agree	Hsu *et al*. (2015) Parasuraman *et al*. (1988) Pitt *et al.* (1995)

APPENDIX C

OTHMAN YEOP ABDULLAH GRADUATE SCHOOL OF BUSINESS
Universiti Utara Malaysia
06010 UUM SINTOK
KEDAH DARUL AMAN
MALAYSIA

Universiti Utara Malaysia

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Faks (Fax): 604-928 7160
Laman Web (Web): www.oyagsb.uum.edu.my

Study Questionnaire

SURVEY OF CORDLIFE GROUP'S
HEALTHCARE ENTERPRISE RESOURCE PLANNING (HERP)
POST-IMPLEMENTATION SUCCESS ASSESSMENT

Dear Sir/Madam,

1. Firstly, we congratulate you as you have been chosen to be one of our valuable respondents in doctoral survey study. This survey questionnaire is part of an academic research study. This study investigates your perception and satisfaction that based on your true experience and feeling while using the HERP system. There is no right or wrong answer. All information given in this questionnaire will be kept **strictly confidential**.

2. If you are registered **CordLife Group Limited / StemLife Berhad HERP user**, then you may **proceed** to complete the survey with truly and honestly.

3. Immediate return of the completed survey is greatly welcome. Otherwise, the researcher will be back to pick-up the questionnaires within 3 working days. If you have any enquiries, you may contact Mr. OH CHUN SIANG at 011-3190 4552 or chunsiang.oh@stemlife.com, a doctoral candidate in area of Business Administration at the Universiti Utara Malaysia, Kuala Lumpur.

4. Supervisor for this study is **Professor Dr. Shahizan Bin Hassan**. He is an academic from Othman Yeoh Abdullah Graduate School of Business (OYAGSB) Universiti Utara Malaysia and can be contacted at +604 - 928 7103 /7106 or shahizan@uum.edu.my.

Lastly, we would like to express sincere appreciation and thank you for your cooperation.

No.	Key Term	Operational Definition
1	HERP	Healthcare Enterprise Resource Planning (HERP) system is an enterprise information system designed to integrate and optimise the business processes and transactions in a corporation.
2	Individual Benefits	Individual benefits refer to the effect of information on the behavior of the recipient or the extent to which the HERP has influenced users' capabilities and effectiveness.
3	User Satisfaction	User satisfaction as the degree to which HERP users are satisfied with the decision to use a system and whether it met their expectation.
4	System Quality	System quality represents the quality of the HERP itself, which includes software and data components and it is a measure of the extent to which the system is technically sound.
5	Information Quality	Information quality refers to the quality of outputs the HERP produces, which can be in the form of reports or online screens.
6	Service Quality	Service quality is defined as the degree to which HERP users are convinced that the necessary resources and technical assistance that delivered by the IS department in the organization.

There are three parts in this survey.

Part I :Respondent perception of information quality, system quality, service quality, user satisfaction and individual benefits.
Part II : Respondent comments and suggestions.
Part III : Respondent demographic information.

PART I: RESPONDENT PERCEPTION ON INFORMATION QUALITY, SYSTEM QUALITY, SERVICE QUALITY, USER SATISFACTION AND INDIVIDUAL BENEFITS

Please read the following statements and **circle the number** that most accurately reflects your perception on each statement.

SCALE

Strong Disagree	Disagree	Neutral	Agree	Strongly Agree
<----------				---------->
1	2	3	4	5

No.	Question	Please circle your answer
HERP Quality: Concerning the HERP you are using, please indicate the degree to which you agree / disagree with the following statements.		
System Quality – *System-related.*		
1	The HERP is easy to use.	1 2 3 4 5
2	The HERP is easy to learn.	1 2 3 4 5
3	The HERP always processes data accurately.	1 2 3 4 5
4	The HERP requires only a minimum number of fields and steps to achieve a task.	1 2 3 4 5
System Quality – *Task-related.*		
5	The HERP meets my requirements.	1 2 3 4 5
6	The HERP includes necessary features and functions for my job.	1 2 3 4 5
7	The HERP user interface can be easily adapted to my personal approach.	1 2 3 4 5
8	The HERP can be easily modified or improved according to my needs.	1 2 3 4 5
Information Quality – *Context.*		
9	The HERP provides output that seems to be exactly what I need.	1 2 3 4 5
10	Information needed from the HERP is always available.	1 2 3 4 5
11	Information from the HERP is in a form that is readily usable.	1 2 3 4 5

SCALE

Strong Disagree	Disagree	Neutral	Agree	Strongly Agree
<---------->				
1	2	3	4	5

No.	Question	Please circle your answer
	Information Quality – *Representation.*	
12	Information from the HERP appears readable, clear and well formatted.	1 2 3 4 5
13	Information from the HERP is concise.	1 2 3 4 5
	Service Quality: Please indicate the degree to which you agree / disagree with the following statements regarding the service quality provided by your company Information System (IS) department in general.	
	Service Quality – *Tangibility.*	
14	IS department has up-to-date hardware and software.	1 2 3 4 5
15	The physical facilities in IS department are visually appealing.	1 2 3 4 5
16	The staff in IS department is well dressed and neat in appearance.	1 2 3 4 5
17	The appearance of the physical facilities of IS department is in keeping with the kind of services provided.	1 2 3 4 5
	Service Quality – *Reliability.*	
18	When IS department promises to do something by a certain time, they will do so.	1 2 3 4 5
19	When users have a problem, IS department shows a sincere interest in solving it.	1 2 3 4 5
20	IS department is dependable.	1 2 3 4 5
21	IS department provides their services at the times they promise.	1 2 3 4 5
22	IS department insists on error-free records.	1 2 3 4 5
	Service Quality – *Responsiveness.*	
23	IS department tells users exactly when services will be performed.	1 2 3 4 5
24	IS department staff gives prompt service to users.	1 2 3 4 5
25	Staff in IS department is never too busy to respond to users' requests.	1 2 3 4 5

SCALE

Strong Disagree	Disagree	Neutral	Agree	Strongly Agree
<----------				---------->
1	2	3	4	5

No.	Question	Please circle your answer
Service Quality – *Assurance*.		
26	The behaviour of staff in IS department instils confidence in users.	1 2 3 4 5
27	I feel safe in my transactions with the IS department staff.	1 2 3 4 5
28	Staff in IS department is consistently courteous with users.	1 2 3 4 5
29	Staff in IS department has the knowledge to do their job well.	1 2 3 4 5
Service Quality – *Empathy*.		
30	IS department has operating hours convenient to all users.	1 2 3 4 5
31	IS department give users personal attentions.	1 2 3 4 5
32	IS department has the users' best interests at heart.	1 2 3 4 5
33	The staff of IS department understands the specific needs of users.	1 2 3 4 5
Post-implementation Success : Concerning the HERP you are using, please indicate the degree to which you agree / disagree with the following statements.		
User Satisfaction		
34	I am satisfied with the system quality.	1 2 3 4 5
35	I am satisfied with the information quality.	1 2 3 4 5
36	I am satisfied with the service quality.	1 2 3 4 5
37	I am satisfied with the overall HERP system.	1 2 3 4 5
Individual Benefits		
38	The HERP improve my learning needs.	1 2 3 4 5
39	The HERP improve my job performance.	1 2 3 4 5
40	The HERP enhances my effectiveness in the job.	1 2 3 4 5
41	The HERP increases my job productivity.	1 2 3 4 5

PART II: RESPONDENT COMMENTS AND SUGGESTIONS

1. What kind of challenges have you faced upon using HERP?

3. What ideas should be taken into considerations for a successful HERP?

3. If you have any comments or suggestions for the betterment of the HERP system, please indicate below:

PART III: RESPONDENT DEMOGRAPHIC INFORMATION

The following information will be used for statistical analysis only. The information will be kept **strictly confidential**.

Please tick one (√) to fill in the appropriate box.

1. Which country of CordLife Group you based:

□Singapore	□Malaysia	□Indonesia
□Hong Kong	□Philippine	□India

2. Department:

□Management	□Sales	□Marketing
□Customer Management	□Finance	□Fulfillment
□Laboratory	□Others:_____	

3. Gender:

□Male	□Female

4. Age:

□25 or below	□26 - 30	□31 – 40
□41 - 50	□Above 50	

5. Highest education:

□SPM/O Level	□Certificate	□Diploma
□Degree	□Master	□Doctoral

6. Position level:

□Non-Executive	□Executive	□Managerial
□Director/CEO/Top Management		

7. Are you using the HERP system?

□Yes	□No

8. Which HERP system that you are using? Tick (√) more than one if needed.

□Microsoft® Dynamics CRM □Microsoft® Dynamics NAVISION
□Others: _____

9. How long have you been using the HERP system?

□ 1 year or less	□ More than 1 – 2 years	□ More than 2 – 3 years
□ More than 3 – 4 years	□ More than 4 years	

THANK YOU

APPENDIX D

Letter to CordLife Group for requesting data of total number of HERP users

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"MUAFAKAT KEDAH"

UUM/OYAGSB/R-4/4/1
31 Disember 2017

STEM LIFE BERHAD
B-7-15, MEGAN AVENUE II
12 JALAN YAP KWAN SENG
50450 KUALA LUMPUR

Dear Sir/Madam,

LETTER OF RECOMMENDATION FOR DATA COLLECTION AND RESEARCH WORK

This is to certify that **Oh Chun Siang (Matric No: 901399)** is a student of Othman Yeop Abdullah Graduate School of Business, Universiti Utara Malaysia Kuala Lumpur pursuing his Doctor of Business Administration (DBA). He is conducting a research entitled ***"Enterprise Resource Planning (ERP) Implementation in Healthcare Industry : A Case Of Cord Life Group Limited"*** under the supervision of Prof. Dr. Shahizan bin Hassan.

In this regard, we hope that you could kindly provide assistance and cooperation for him to successfully complete the research. All the information gathered will be strictly used for academic purposes only.

Your cooperation and assistance is very much appreciated.

Thank you.

"ILMU, BUDI, BAKTI"

Yours faithfully,

ROZITA RAMLI
Assistant Registrar
For Dean
Othman Yeop Abdullah Graduate School of Business

c.c - Supervisor
- Student's File (901399)

APPENDIX E

The results of the D^2 (MAH_1 in SPSS) for CGL-Singapore

No.	Samples Ref. No.	D^2	Probability DM	Outlier (Y/N)	No.	Samples Ref. No.	D^2	Probability DM	Outlier (Y/N)
1	27	25.2058	0.0049	N	46	140	12.2521	0.2685	N
2	158	24.8162	0.0053	N	47	143	12.2184	0.2707	N
3	134	23.8817	0.0080	N	48	123	12.1550	0.2748	N
4	145	23.8136	0.0081	N	49	172	12.1324	0.2763	N
5	109	23.3083	0.0097	N	50	120	12.0822	0.2796	N
6	98	21.9445	0.0154	N	51	154	12.0082	0.2845	N
7	148	21.6122	0.0172	N	52	117	11.8544	0.2949	N
8	49	21.1581	0.0200	N	53	136	11.7892	0.2994	N
9	181	20.7836	0.0227	N	54	106	11.7608	0.3014	N
10	138	20.0917	0.0284	N	55	132	11.7547	0.3018	N
11	130	19.9794	0.0294	N	56	180	11.6770	0.3073	N
12	17	19.0244	0.0400	N	57	183	11.6691	0.3078	N
13	160	18.6855	0.0444	N	58	153	11.6138	0.3117	N
14	38	17.9923	0.0551	N	59	33	11.3651	0.3298	N
15	112	17.3653	0.0667	N	60	129	11.3377	0.3318	N
16	115	16.8362	0.0781	N	61	46	11.0744	0.3517	N
17	170	16.6032	0.0836	N	62	83	11.0663	0.3524	N
18	114	16.3698	0.0895	N	63	131	10.9664	0.3601	N
19	1	16.3308	0.0905	N	64	111	10.9412	0.3621	N
20	92	16.2863	0.0917	N	65	62	10.8871	0.3664	N
21	28	16.0175	0.0991	N	66	73	10.7281	0.3791	N
22	22	15.5359	0.1137	N	67	47	10.7093	0.3806	N
23	14	15.3551	0.1196	N	68	71	10.6259	0.3874	N
24	137	15.2669	0.1226	N	69	68	10.6232	0.3876	N
25	113	15.0131	0.1316	N	70	32	10.5730	0.3917	N
26	79	14.9822	0.1327	N	71	151	10.4734	0.4000	N
27	36	14.1644	0.1656	N	72	58	10.3617	0.4094	N
28	94	14.1227	0.1675	N	73	13	10.2452	0.4193	N
29	18	13.8675	0.1791	N	74	19	10.0958	0.4321	N
30	166	13.4027	0.2020	N	75	124	10.0763	0.4338	N
31	37	13.3470	0.2049	N	76	169	10.0502	0.4361	N
32	177	13.1029	0.2180	N	77	84	9.8897	0.4502	N
33	39	13.0964	0.2183	N	78	82	9.8575	0.4531	N
34	64	12.9457	0.2267	N	79	59	9.8250	0.4560	N
35	45	12.8054	0.2348	N	80	174	9.8133	0.4570	N
36	52	12.7556	0.2377	N	81	15	9.8019	0.4580	N
37	48	12.7264	0.2394	N	82	89	9.7791	0.4601	N
38	139	12.7218	0.2396	N	83	43	9.7163	0.4657	N
39	157	12.7189	0.2398	N	84	26	9.5480	0.4810	N
40	95	12.6867	0.2417	N	85	90	9.5407	0.4817	N
41	107	12.5452	0.2502	N	86	101	9.4624	0.4889	N
42	99	12.3579	0.2618	N	87	146	9.4002	0.4946	N
43	55	12.3354	0.2632	N	88	75	9.3449	0.4997	N
44	12	12.2955	0.2658	N	89	57	9.3227	0.5018	N
45	159	12.2736	0.2672	N	90	104	9.2851	0.5053	N

APPENDIX E (Continued)

No.	Samples Ref. No.	D^2	Probability DM	Outlier (Y/N)
91	29	9.2679	0.5069	N
92	9	9.2487	0.5087	N
93	150	9.2176	0.5116	N
94	44	9.1742	0.5157	N
95	167	9.1463	0.5183	N
96	67	9.1126	0.5215	N
97	175	9.0312	0.5291	N
98	86	8.9365	0.5381	N
99	88	8.7116	0.5597	N
100	91	8.6998	0.5608	N
101	85	8.6083	0.5696	N
102	122	8.6064	0.5698	N
103	10	8.5568	0.5746	N
104	66	8.4668	0.5833	N
105	78	8.4584	0.5842	N
106	63	8.4175	0.5881	N
107	31	8.4082	0.5890	N
108	50	8.3746	0.5923	N
109	127	8.3250	0.5971	N
110	53	8.3168	0.5979	N
111	149	8.3004	0.5995	N
112	176	8.2209	0.6073	N
113	77	8.1980	0.6095	N
114	121	8.1524	0.6140	N
115	61	8.0493	0.6240	N
116	118	7.7489	0.6533	N
117	3	7.5961	0.6682	N
118	184	7.5450	0.6732	N
119	135	7.5008	0.6775	N
120	161	7.4354	0.6838	N
121	168	7.3308	0.6939	N
122	42	7.3008	0.6968	N
123	97	7.2810	0.6987	N
124	102	7.1826	0.7081	N
125	96	7.0925	0.7167	N
126	152	6.6969	0.7537	N
127	74	6.6200	0.7608	N
128	7	6.5037	0.7713	N
129	142	6.4122	0.7795	N
130	56	6.3745	0.7829	N
131	70	6.3535	0.7847	N
132	80	6.3352	0.7864	N
133	144	6.3297	0.7868	N
134	40	6.3060	0.7889	N
135	110	6.2272	0.7958	N
136	30	6.1042	0.8064	N
137	119	6.0848	0.8081	N
138	171	6.0612	0.8101	N
139	182	6.0531	0.8108	N
140	93	5.9911	0.8160	N
141	54	5.9470	0.8197	N
142	81	5.7750	0.8338	N
143	34	5.6673	0.8424	N
144	105	5.5794	0.8493	N
145	128	5.5648	0.8504	N
146	24	5.5050	0.8550	N
147	126	5.4429	0.8597	N
148	11	5.4025	0.8627	N
149	162	5.3532	0.8664	N
150	72	5.3402	0.8673	N
151	147	5.2952	0.8706	N
152	178	5.2557	0.8735	N
153	164	4.9685	0.8933	N
154	103	4.9429	0.8950	N
155	23	4.8476	0.9011	N
156	141	4.8235	0.9027	N
157	116	4.8204	0.9029	N
158	165	4.6705	0.9121	N
159	25	4.6302	0.9145	N
160	51	4.3814	0.9285	N
161	163	4.2950	0.9331	N
162	21	4.0863	0.9434	N
163	173	4.0078	0.9470	N
164	69	3.9187	0.9509	N
165	35	3.8994	0.9518	N
166	16	3.8857	0.9524	N
167	87	3.8206	0.9551	N
168	155	3.7839	0.9566	N
169	41	3.7688	0.9572	N
170	179	3.7557	0.9577	N
171	125	3.7383	0.9584	N
172	100	3.7010	0.9598	N
173	133	3.6141	0.9631	N
174	20	3.5447	0.9656	N
175	6	3.5278	0.9661	N
176	4	3.2256	0.9756	N
177	2	3.1191	0.9785	N
178	60	2.6229	0.9890	N
179	5	2.5842	0.9896	N
180	8	1.9895	0.9964	N
181	108	1.9501	0.9967	N
182	76	1.8189	0.9975	N
183	156	1.1942	0.9996	N
184	65	1.1755	0.9996	N

APPENDIX F

The results of the D^2 (MAH_2 in SPSS) for SLB-Malaysia

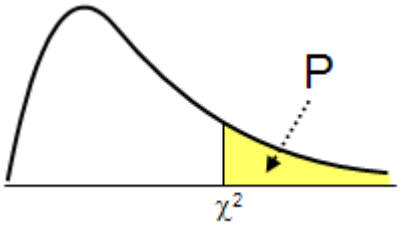
No.	Samples Ref. No.	D^2	Probability DM	Outlier (Y/N)	No.	Samples Ref. No.	D^2	Probability DM	Outlier (Y/N)
1	49	28.7908	0.0019	N	46	32	12.2643	0.2678	N
2	72	27.7153	0.0023	N	47	135	12.2519	0.2685	N
3	154	27.2213	0.0025	N	48	50	12.2108	0.2712	N
4	15	26.8235	0.0028	N	49	39	12.1889	0.2726	N
5	126	26.7633	0.0028	N	50	80	12.0458	0.2820	N
6	130	25.2542	0.0049	N	51	171	11.9552	0.2881	N
7	134	22.2215	0.0140	N	52	174	11.8710	0.2938	N
8	42	19.8592	0.0306	N	53	92	11.8589	0.2946	N
9	83	19.7580	0.0316	N	54	40	11.8539	0.2950	N
10	141	17.9935	0.0551	N	55	8	11.8117	0.2979	N
11	29	17.4739	0.0645	N	56	155	11.5936	0.3132	N
12	82	17.4634	0.0647	N	57	14	11.5404	0.3170	N
13	23	17.2740	0.0685	N	58	79	11.4794	0.3214	N
14	6	16.7497	0.0801	N	59	133	11.2343	0.3396	N
15	144	16.6431	0.0826	N	60	11	11.1725	0.3442	N
16	109	16.0637	0.0978	N	61	163	10.5684	0.3921	N
17	31	15.9610	0.1008	N	62	89	10.5159	0.3965	N
18	156	15.6519	0.1100	N	63	132	10.5111	0.3969	N
19	128	15.5427	0.1135	N	64	108	10.4840	0.3991	N
20	85	15.2748	0.1224	N	65	178	10.2792	0.4164	N
21	111	15.2590	0.1229	N	66	12	10.2293	0.4206	N
22	69	15.0572	0.1300	N	67	60	10.0833	0.4332	N
23	110	14.9068	0.1355	N	68	73	10.0023	0.4403	N
24	2	14.8384	0.1381	N	69	157	9.9440	0.4454	N
25	173	14.5591	0.1490	N	70	20	9.9408	0.4457	N
26	1	14.5139	0.1508	N	71	149	9.8514	0.4536	N
27	17	13.9904	0.1734	N	72	95	9.8474	0.4540	N
28	67	13.9657	0.1746	N	73	125	9.8195	0.4565	N
29	160	13.8870	0.1782	N	74	30	9.8098	0.4573	N
30	101	13.5875	0.1927	N	75	93	9.7604	0.4618	N
31	107	13.2706	0.2089	N	76	9	9.7015	0.4671	N
32	59	13.1792	0.2138	N	77	34	9.6235	0.4741	N
33	147	13.0990	0.2182	N	78	16	9.6213	0.4743	N
34	70	13.0658	0.2200	N	79	66	9.5797	0.4781	N
35	120	13.0642	0.2201	N	80	57	9.5348	0.4822	N
36	150	13.0624	0.2202	N	81	166	9.4707	0.4881	N
37	113	12.8670	0.2312	N	82	146	9.4547	0.4896	N
38	71	12.7533	0.2378	N	83	117	9.4397	0.4909	N
39	44	12.7235	0.2395	N	84	94	9.3099	0.5030	N
40	168	12.5693	0.2488	N	85	43	9.3039	0.5035	N
41	77	12.5199	0.2518	N	86	4	9.2444	0.5091	N
42	98	12.4174	0.2581	N	87	103	9.2382	0.5097	N
43	136	12.3736	0.2608	N	88	61	9.2089	0.5124	N
44	47	12.3608	0.2616	N	89	153	9.1512	0.5178	N
45	139	12.3149	0.2645	N	90	176	9.1092	0.5218	N

APPENDIX F (Continued)

No.	Samples Ref. No.	D^2	Probability DM	Outlier (Y/N)	No.	Samples Ref. No.	D^2	Probability DM	Outlier (Y/N)
91	51	8.9851	0.5335	N	136	75	6.4749	0.7739	N
92	177	8.9449	0.5373	N	137	143	6.3548	0.7846	N
93	127	8.9330	0.5385	N	138	21	6.3337	0.7865	N
94	119	8.9171	0.5400	N	139	26	6.2389	0.7948	N
95	148	8.8851	0.5430	N	140	140	6.1792	0.8000	N
96	167	8.8377	0.5476	N	141	161	6.1639	0.8013	N
97	142	8.7461	0.5564	N	142	100	6.1049	0.8064	N
98	116	8.6383	0.5667	N	143	53	6.0109	0.8143	N
99	175	8.6289	0.5676	N	144	91	5.8463	0.8280	N
100	86	8.6067	0.5698	N	145	115	5.8040	0.8315	N
101	170	8.5972	0.5707	N	146	52	5.7543	0.8355	N
102	179	8.5709	0.5733	N	147	22	5.7447	0.8362	N
103	104	8.5244	0.5778	N	148	10	5.7423	0.8364	N
104	78	8.3531	0.5944	N	149	25	5.5963	0.8480	N
105	24	8.3339	0.5963	N	150	36	5.2762	0.8720	N
106	27	8.2563	0.6038	N	151	137	5.2133	0.8765	N
107	102	8.1851	0.6108	N	152	58	5.1894	0.8782	N
108	38	8.1288	0.6163	N	153	159	4.9963	0.8914	N
109	13	8.0321	0.6257	N	154	48	4.9379	0.8953	N
110	131	8.0070	0.6282	N	155	169	4.9168	0.8967	N
111	3	7.8746	0.6411	N	156	28	4.8332	0.9020	N
112	164	7.8273	0.6457	N	157	62	4.6144	0.9154	N
113	124	7.5462	0.6731	N	158	68	4.6007	0.9162	N
114	84	7.5462	0.6731	N	159	90	4.4072	0.9271	N
115	145	7.4505	0.6823	N	160	96	4.3954	0.9278	N
116	118	7.4299	0.6843	N	161	158	4.1446	0.9406	N
117	76	7.4122	0.6860	N	162	162	4.1370	0.9410	N
118	122	7.3532	0.6917	N	163	121	4.1248	0.9415	N
119	45	7.3052	0.6964	N	164	88	4.0492	0.9451	N
120	5	7.2651	0.7002	N	165	35	4.0093	0.9469	N
121	99	7.1264	0.7135	N	166	54	3.9938	0.9476	N
122	165	7.1030	0.7157	N	167	172	3.9522	0.9495	N
123	56	6.8885	0.7359	N	168	151	3.8517	0.9538	N
124	106	6.8256	0.7418	N	169	129	3.5547	0.9652	N
125	63	6.8085	0.7434	N	170	41	3.5210	0.9664	N
126	114	6.8078	0.7435	N	171	18	3.4198	0.9698	N
127	123	6.7934	0.7448	N	172	46	3.3961	0.9705	N
128	33	6.7470	0.7491	N	173	64	3.2883	0.9738	N
129	65	6.6138	0.7613	N	174	81	3.1822	0.9768	N
130	97	6.6034	0.7623	N	175	55	3.0763	0.9796	N
131	138	6.5637	0.7659	N	176	7	2.8910	0.9839	N
132	105	6.5483	0.7673	N	177	87	2.6495	0.9885	N
133	74	6.5199	0.7699	N	178	180	2.1956	0.9946	N
134	112	6.4915	0.7724	N	179	37	2.1517	0.9950	N
135	19	6.4776	0.7737	N	180	152	0.9086	0.9999	N

APPENDIX G

Table of Chi-square



	P										
DF	**0.995**	**0.975**	**0.2**	**0.1**	**0.05**	**0.025**	**0.02**	**0.01**	**0.005**	**0.002**	**0.001**
1	0.0000393	0.000982	1.642	2.706	3.841	5.024	5.412	6.635	7.879	9.550	10.828
2	0.010	0.051	3.219	4.605	5.991	7.378	7.824	9.210	10.597	12.429	13.816
3	0.072	0.216	4.642	6.251	7.815	9.348	9.837	11.345	12.838	14.796	16.266
4	0.207	0.484	5.989	7.779	9.488	11.143	11.668	13.277	14.860	16.924	18.467
5	0.412	0.831	7.289	9.236	11.070	12.833	13.388	15.086	16.750	18.907	20.515
6	0.676	1.237	8.558	10.645	12.592	14.449	15.033	16.812	18.548	20.791	22.458
7	0.989	1.690	9.803	12.017	14.067	16.013	16.622	18.475	20.278	22.601	24.322
8	1.344	2.180	11.030	13.362	15.507	17.535	18.168	20.090	21.955	24.352	26.124
9	1.735	2.700	12.242	14.684	16.919	19.023	19.679	21.666	23.589	26.056	27.877
10	2.156	3.247	13.442	15.987	18.307	20.483	21.161	23.209	25.188	27.722	29.588
11	2.603	3.816	14.631	17.275	19.675	21.920	22.618	24.725	26.757	29.354	31.264
12	3.074	4.404	15.812	18.549	21.026	23.337	24.054	26.217	28.300	30.957	32.909
13	3.565	5.009	16.985	19.812	22.362	24.736	25.472	27.688	29.819	32.535	34.528
14	4.075	5.629	18.151	21.064	23.685	26.119	26.873	29.141	31.319	34.091	36.123
15	4.601	6.262	19.311	22.307	24.996	27.488	28.259	30.578	32.801	35.628	37.697
16	5.142	6.908	20.465	23.542	26.296	28.845	29.633	32.000	34.267	37.146	39.252
17	5.697	7.564	21.615	24.769	27.587	30.191	30.995	33.409	35.718	38.648	40.790
18	6.265	8.231	22.760	25.989	28.869	31.526	32.346	34.805	37.156	40.136	42.312
19	6.844	8.907	23.900	27.204	30.144	32.852	33.687	36.191	38.582	41.610	43.820
20	7.434	9.591	25.038	28.412	31.410	34.170	35.020	37.566	39.997	43.072	45.315
21	8.034	10.283	26.171	29.615	32.671	35.479	36.343	38.932	41.401	44.522	46.797
22	8.643	10.982	27.301	30.813	33.924	36.781	37.659	40.289	42.796	45.962	48.268
23	9.260	11.689	28.429	32.007	35.172	38.076	38.968	41.638	44.181	47.391	49.728
24	9.886	12.401	29.553	33.196	36.415	39.364	40.270	42.980	45.559	48.812	51.179
25	10.520	13.120	30.675	34.382	37.652	40.646	41.566	44.314	46.928	50.223	52.620
26	11.160	13.844	31.795	35.563	38.885	41.923	42.856	45.642	48.290	51.627	54.052
27	11.808	14.573	32.912	36.741	40.113	43.195	44.140	46.963	49.645	53.023	55.476
28	12.461	15.308	34.027	37.916	41.337	44.461	45.419	48.278	50.993	54.411	56.892
29	13.121	16.047	35.139	39.087	42.557	45.722	46.693	49.588	52.336	55.792	58.301
30	13.787	16.791	36.250	40.256	43.773	46.979	47.962	50.892	53.672	57.167	59.703